CHAPTER 14

AMERICAN SPACE HISTORY: LEGACIES, QUESTIONS, AND OPPORTUNITIES FOR FUTURE RESEARCH[1]

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In the 35 years since astronauts Neil A. Armstrong and Buzz Aldrin set foot on the Moon, no space achievement has quite captured people's imaginations as Apollo. Thirty-five years after that singular event, the specter of Apollo still looms large as a benchmark for all that came later. In the context of the current inertia of the American space program—the Space Shuttle temporarily grounded while astronauts take to orbit in Russian rockets for unimaginative tours of the International Space Station—Apollo retains an even stronger pull to those seeking adventure and exploration.[2] Given Apollo's centrality in popular conceptions of the history of the space program, it is not surprising that historical writing—both popular and academic—has been shaped profoundly by the experience of the Moon landings. Even those areas of space history that have no apparent connection to Apollo, such as military space history, for example, assume their historical places in our memory in relation to Apollo. Because of the project's status as being emblematic of a lost, young, and adventurous America, space historians negotiating the delicate boundaries between memory and nostalgia have typically veered from the former to the latter with an ease that underscores more about the state of the current space program than the one that actually happened. In addition, Apollo's huge shadow has helped to marginalize many important but unexplored areas of space history.

In the past 40 years of space history, historians have worked within several interpretive approaches to space history, all of them defined and demarcated by the shadow of Apollo and its political backdrop, the Cold War. This essay is an attempt to revisit that historiography in search of some common unify-

1. I would like to thank Dwayne A. Day, Steven J. Dick, Roger D. Launius, and Michael J. Neufeld for their helpful comments.

2. For the current crisis, see Roger D. Launius, "After Columbia: The Space Shuttle Program and the Crisis in Access to Space," *Astropolitics* 2 (July–September 2004): 277–322.

ing themes.[3] The goal is to identify certain interpretive and narrative patterns and then elaborate on areas where scholarship is lacking or where important questions remain unexplored.[4] A close reading of the literature shows that historians have located their work within four different narratives based around exploration, competition, technology, and the astronauts. These interpretive paradigms continue to dominate and define our understanding of the origins, evolution, and nature of the American space program. The categories were not mutually exclusive, and the approaches have overlapped over time, but these four guiding themes have remained as important explanatory devices. Some saw the space program as indicative of Americans' "natural" urge to explore the frontier; some believed that the space program was a surrogate for a larger struggle between good and evil; others wrote of a space program whose main force was modern American technology; and others described a space program whose central actors were hero astronauts, representing all that was noble in American culture.[5]

In all of the four schools, which continue to flourish today, historians have typically examined the history from the top looking down, describing only the tallest trees of a vast forest of society and culture. The first generation of scholarship was distinguished by a focus on linear, narrow, and progress-oriented narratives unencumbered by context, critique, or culture. Historians also shared a nostalgic yearning for the 1960s, the halcyon period of American space exploration. Like the space program itself, historians repeatedly romanticized the claimed victories of Apollo without questioning many of the incontrovertible motivations and repercussions of the space program.

Starting in the 1980s but really coming to fruition in the 1990s, a "new aerospace history" began to emerge. Building on a few notable works published during the late Cold War, a new generation of historians tackled the history of American space exploration from different perspectives involving politics, society, and culture. These new works distinguished themselves from the older canon because they revisited, cajoled, and questioned some of the basic foundational notions of the received space history. Some did so explic-

3. For earlier works on the historiography of American space exploration, see Richard P. Hallion, "A Source Guide to the History of Aeronautics and Astronautics," *American Studies International* 20, no. 3 (1982): 3–50; Hunter A. Dupree, "The History of the Exploration of Space: From Official History to Contributions to Historical Literature," *Public Historian* 8 (1986): 121–128; Pamela E. Mack, "Space History," *Technology and Culture* 30 (1989): 657–665; Roger D. Launius, "The Historical Dimension of Space Exploration: Reflections and Possibilities," *Space Policy* 16 (2000): 23–38.

4. In the paper, I do not distinguish between the often false dichotomy of academic versus popular works. Important contributions to space history have come from both ends of the spectrum, and both have had their strengths and weaknesses. I also do not explore the study of international cooperation in space history, a vast topic covered by others in this volume. Finally, due to limitations of length, I omit discussion of those histories dedicated to the events of the pre-Sputnik era.

5. I list and describe representative examples from each group in the main body of the essay.

itly, others more implicitly. The new history also moved beyond the lenses of competition, exploration, technology, or astronauts. In some cases, the literature built upon the older models, while in others, it made a clean break from the older canon.

Historians also moved into new areas of political, technological, social, and cultural history benefiting from a shared interest in new sources and new methodological approaches. Simultaneously, the old Cold War paradigm of historiography continues to flourish, propagated especially in several syntheses, creating an interpretive tension between the old and new writing that may promote a middle ground in the future. Whether this mix will generate new, interesting, and challenging ideas remains to be seen, but it has been healthy for the field to expand beyond the previously narrow borders, if for nothing else to link and relocate space history, not as something peculiar and unique, but as part of a broader inquiry into American history.

EXPLORATION

The most common motif in space historiography has been that of locating space exploration as part of an eons-long human urge to push the geographical frontiers of existence. Prescriptive works on space exploration published in the pre-Sputnik era—some of which assumed iconic status in later years—firmly established such an approach to history. A harbinger of this paradigm was Willy Ley, a veteran of early amateur German rocketry groups from the 1930s. Updating a book he had first authored in 1944 through 21 printings, Ley's *Rockets, Missiles, and Man in Space* (1968) was a landmark publication that former NASA Chief Historian Roger D. Launius has called "one of the most significant textbooks available in the mid-twentieth century on the possibilities of space travel."[6] A popular historical narrative tracing the evolution of rocket technology from the ancient Babylonians to the mid-1960s, Ley's work weaved together human imperatives and technical evolution in a seamless whole. From the beginning, he described his book as "the story of the idea that we possibly could, and if so should, break away from our planet and go exploring to others, just as thousands of years ago men broke away from their islands and went exploring to other coasts."[7] By focusing on a few scattered, talented individuals with a vision of space travel, Ley delineated the history of space

6. Roger D. Launius, *Frontiers of Space Exploration* (Westport, CT: Greenwood Press, 1998), p. 190; Willy Ley, *Rockets, Missiles, and Men in Space* (New York: Viking Press, 1968). Ley also published an abridged and slightly updated version of his book the following year as *Events in Space* (New York: D. McKay, 1969).

7. Willy Ley, *Rockets: The Future of Travel Beyond the Stratosphere* (New York: The Viking Press, 1945), p. 3. In popular history, others have connected space history to the exploration paradigm. See, for example, Daniel J. Boorstin, *The Discoverers* (New York: Random House, 1983).

exploration as essentially one with an individualistic character. In Ley's world, technology, i.e., the means to fulfill these singular visions, was subordinated to the needs and whims of resourceful scientists or engineers whom he called "Prophets of Some Honor." Thus, the principal actors behind space exploration were neither nations nor states, but noble visionaries. Ley also established a pantheon of icons for the future history of space; by giving currency to such names as Konstantin Tsiolkovskiy, Hermann Oberth, and Robert Goddard, he gave a face to the technology.[8] German rocketry pioneer Wernher von Braun's *History of Rocketry and Space Travel* (1966) (cowritten with Frederick I. Ordway III) built upon Ley's work and cemented a number of unquestioned narratives about the origins of the "Space Age," including the centrality of von Braun's V-2 "rocket team" in the postwar American rocket and space program, thus marginalizing a number of other equally important indigenous innovators in the American context such as the Guggenheim Aeronautical Laboratory at Caltech (GALCIT) and the American Rocket Society.[9] So powerful was this synthesis that to this day, almost all history books on space exploration begin by invoking Tsiolkovskiy, Oberth, and Goddard—and then move to von Braun's rocket team.

What these pioneers had in common was a sustained belief that the human spirit was possessed of an indomitable urge to explore and, as a corollary, to seek knowledge. In one of his most oft-repeated quotes, the Russian theoretician Konstantin Tsiolkovskiy (1857–1935) had written that "the earth is the cradle of reason, but one cannot live in a cradle forever."[10] For the historian of the American space program, reason was combined with a modern version of manifest destiny, a marriage of the near-spiritual urge to explore new frontiers and the cold, hard rationale of technology. One of the earliest scholarly works to equate the idea of the American West with the space fron-

8. For biographies, see Helen B. Walters, *Hermann Oberth: Father of Space Travel* (New York: Macmillan, 1962); Hans Barth, *Hermann Oberth: Vater der Raumfahrt: autorisierte Biographie* (Esslingen: Bechtle, 1991); David A. Clary, *Rocket Man: Robert H. Goddard and the Birth of the Space Age* (New York: Hyperion, 2003); Milton Lehman, *This High Man: The Life of Robert H. Goddard* (New York: Farrar, Straus, 1963); A. Kosmodemiansky, *Konstantin Tsiolkovsky, 1857–1935* (Moscow: Nauka, 1985).

9. Wernher von Braun and Frederick I. Ordway III, *History of Rocketry and Space Travel* (New York: Thomas Y. Cromwell Company, 1966). The book was published in revised editions in 1969, 1975, and 1985. The final edition was published as *Space Travel: A History* (New York: Harper & Row, 1985).

10. K. Tsiolkovskii, "Issledovanie mirovykh prostranstv reaktivnymi priborami (1911–1912 gg.)," in *Izbrannye trudy*, ed. B. N. Vorob'ev and V. N. Sokol'skii (Moscow: Nauka, 1962), p. 196. The original phrase was "Планета есть колыбель разума, но нельзя вечно жить в колыбели," or "*Planeta est' kolybel' razuma, no nel'zia vechno zhit' v kolybeli.*" For typical references to the quote, see A. A. Kosmodemyansky, *K. E. Tsiolkovsky—His Life and Work* (Moscow: Nauka, 1960), p. 153; William Shelton, *Soviet Space Exploration: The First Decade* (New York: Washington Square Press, 1968), pp. 12–13; Roger D. Launius, *Space Stations: Base Camps to the Stars* (Washington, DC: Smithsonian Books, 2003), p. 9.

tier was *The Railroad and the Space Program: An Exploration in Historical Analogy* (1965), a collection of essays which used the American railroad as a metaphor for the slow human migration into space.[11] These early works foreshadowed and exemplified an important thread in the future of space history, equating the American frontier in the West with the space frontier beyond the Earth.

Through the past 50 years, those looking ahead, such as policy-makers and spaceflight advocates from John F. Kennedy to Wernher von Braun to Mars Society President Robert Zubrin, have used Frederick Jackson Turner's frontier motif to inspire, justify, and advocate space exploration on a grand scale.[12] Those looking back, especially space historians, have also invoked the frontier thesis to explain the majesty of the early years of American space exploration; they have explained not only how engagement with the frontier has shaped American society and culture, but also how the foundations of American society and culture—particularly democracy and individualism—have shaped space exploration. The frontier ideal resonated partly because, like space explorers, many of the original explorers of the West shared utopian ideals.[13] The space program represented a potent union of two powerful strands of American culture, the search for utopia and the belief in the power of technology, a manifestation of 20th-century technological utopianism.[14] In the 1960s, at a time when the emerging reevaluation of the frontier thesis and its attendant costs to both the environment and the native peoples of the continent had yet to enter the mainstream discourse in American history, the use of the West as a guiding analogy for space exploration implied expansion, development, freedom, and ultimately liberation from the chains of previous existence. If there were pitfalls in exploration, they were minimal at best.[15] These markers of frontier exploration resonated deeply with many histori-

11. Bruce Mazlish, ed., *The Railroad and the Space Program: An Exploration in Historical Analogy* (Cambridge, MA: MIT, 1965).

12. For Frederick Jackson Turner's original works on the frontier thesis, see John Mack Faragher, ed., *Rereading Frederick Jackson Turner: The Significance of the Frontier in American History and Other Essays* (New Haven, CT: Yale University Press, 1994); George Rogers Taylor, *The Turner Thesis: Concerning the Role of the Frontier in American History*, 3rd ed. (Lexington, MA: Heath, 1972). For the frontier's resonance in modern times, see Richard Slotkin, *Gunfighter Nation: The Myth of the Frontier in Twentieth Century America* (New York: Atheneum, 1992). Roger D. Launius gives some notable examples of prominent advocates invoking the frontier thesis in the 1960s in his "Historical Dimension of Space Exploration."

13. Roger D. Launius, "Perfect Worlds, Perfect Societies: The Persistent Goal of Utopia in Human Spaceflight," *Journal of the British Interplanetary Society* 56 (2003): 338–349.

14. For an excellent look at the origins of technological utopianism in American culture, see Howard P. Segal, *Technological Utopianism in American Culture* (Chicago: University of Chicago Press, 1985).

15. For critiques of the frontier thesis, see Patricia Nelson Limerick, Clyde A. Milner II, and Charles E. Rankin, eds., *Trails: Toward a New Western History* (Lawrence: University Press of Kansas, 1991); Richard White, *It's Your Misfortune and None of My Own: A New History of the American West* (Norman: Oklahoma University Press, 1991).

ans, enough that many still invoke them in the 21st century. Describing the parallel paths of the Russian and American space programs, author Robert Zimmerman, in *Leaving Earth: Space Stations, Rival Superpowers, and the Quest for Interplanetary Travel* (2003), compared them to colonization of Earthly landscapes: "The ancestors of both peoples were pioneers . . . . The land both groups settled was harsh, brutal, and unyielding. Death was omnipresent. Out of these two pioneer struggles have risen nations able to forge in the sky the first rockets, the first spacecraft, and the first tentative and grand attempts to colonize the stars."[16] Similar notions run through Bruce C. Murray's *Journey into Space: The First Three Decades of Space Exploration* (1989) and William E. Burrows's *Exploring Space: Voyages in the Solar System and Beyond* (1990), both of which explicitly deal with deep space exploration by robotic probes.[17] That Earthly exploration remains a powerful motif for making sense of space exploration is exemplified best by *Where Next, Columbus? The Future of Space Exploration* (1994), a collection of meditations by prominent historians that link Columbus's seabound trip to the early years of space exploration.[18]

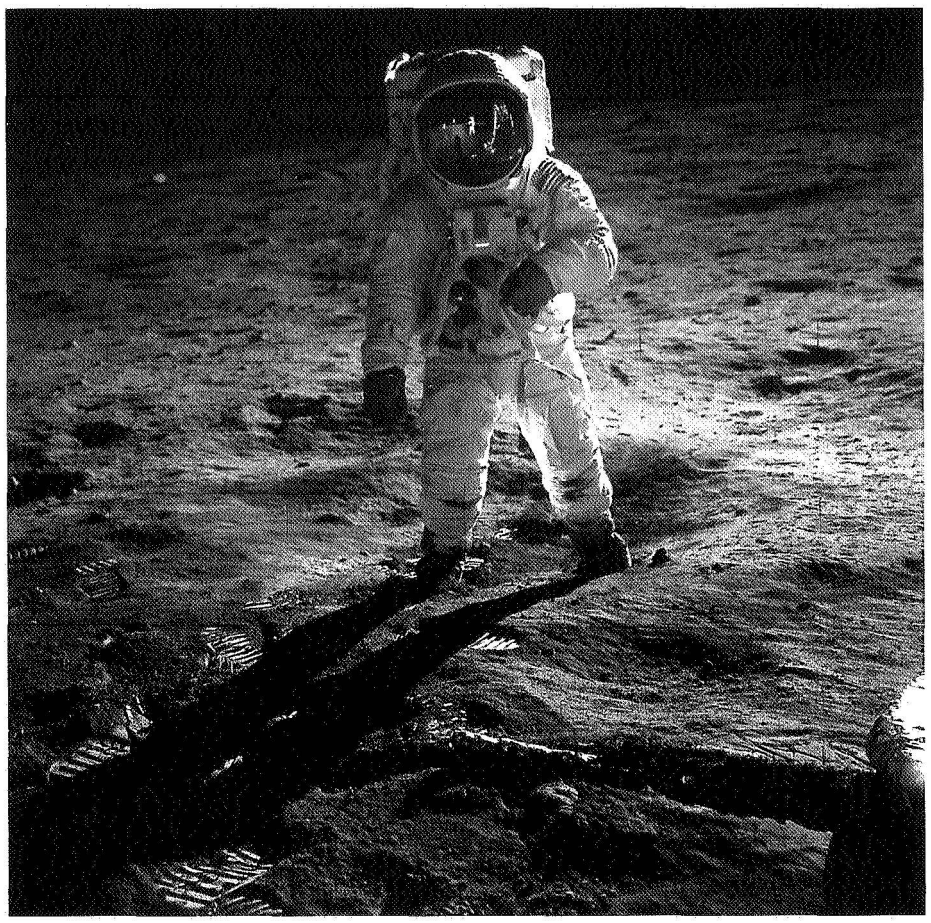
Once the landing of Apollo astronauts on the Moon in July 1969 effectively ended the "space race" for the United States, historians took up the challenge of chronicling this extraordinary technological achievement in a multitude of works, many of which framed the project as part of the human exploration imperative. Unlike many other programs of the 1960s, or indeed since, the Apollo program represented a perfect distillation of interpretive approaches that focused on exploration since the Apollo missions had geographical delimiters that paralleled exploration of the West: beginning from the known, the Earth, voyagers set out in a very physical way for the unknown, the Moon. In contrast, the hundreds of Earth-orbital missions since 1972, while risky and adventurous, have not represented physical movement in the same way Apollo did.[19] NASA managers early on recognized Apollo's exceptionalist nature within the space program. In the introduction to one of the first volumes to reflect on Apollo, then–NASA Administrator James C. Fletcher explicitly located the Apollo expeditions as part of a tradition stretch-

16. Robert Zimmerman, *Leaving Earth: Space Stations, Rival Superpowers, and the Quest for Interplanetary Travel* (Washington, DC: Joseph Henry Press, 2003), p. 460.

17. Bruce C. Murray, *Journey into Space: The First Three Decades of Space Exploration* (New York: W. W. Norton, 1989); William E. Burrows, *Exploring Space: Voyages in the Solar System and Beyond* (New York: Random House, 1990).

18. Valerie Neal, ed., *Where Next, Columbus? The Future of Space Exploration* (New York: Oxford University Press, 1994). See also Peter Bond, *Reaching for the Stars: An Illustrated History of Manned Spaceflight*, 2nd ed. (London: Cassell, 1996).

19. Deam argues that "this shift has essentially emptied the [space] program of its public character, moving spaceflight from an open embrace of political action to closed concerns with economics and technological determinism" (Dirk Deam, "Public Space: Exploring the Political Dimensions of the American Space Program" [Ph.D. diss., University of Iowa, 1999]).



Since the time of the Apollo 11 Moon landing in 1969, space history has matured into a much more rigorous and complex area of study, one with which the theme of exploration has long been associated. No photograph better illustrates this connection than the image of Buzz Aldrin on the Moon. It has assumed iconic proportions in modern society. *(NASA image no. AS11-40-5903)*

ing back to the Pilgrims at Plymouth and Darwin's voyages on the HMS *Beagle*; both were "ventures into uncharted waters."[20] Similarly, Harry Hurt III, in his *For All Mankind* (1988), compared the Apollo missions to Earthly explorations, specifically invoking "Christopher Columbus's daring voyage to the New World."[21]

20. James C. Fletcher, "Foreword," in *Apollo Expeditions to the Moon*, ed. Edgar M. Cortright (Washington, DC: NASA, 1975).

21. Harry Hurt III, *For All Mankind* (New York: The Atlantic Monthly Press Book, 1988), p. xiii.

Beyond linking the great Earthly explorations and migrations with the Apollo expeditions, early works on Apollo, such as the Apollo 11 astronauts' (ghostwritten) *First on the Moon* (1970) and Richard Lewis's *The Voyages of Apollo: The Exploration of the Moon* (1974), focused predominantly on the people at the tip of the iceberg, i.e., the astronauts who performed the missions.[22] Two decades later, Andrew Chaikin's landmark *A Man on the Moon* (1994) continued in this vein, merging the exploration motif with the astronauts' perspectives on the project while omitting any interpretive look at the broader political, social, or cultural factors behind Apollo.[23] By focusing exclusively on the thoughts of the astronauts, the details of the missions, and the nuances of the technology, Chaikin masterfully conveyed the experience of Apollo as if it were one in which only a few dozen people were involved. Context was provided only to the extent that the news media reported it at the time of the Apollo missions.[24] Thus, in one sense, in the historiography of the space program, Apollo became a national, even global experience that was conceived, executed, and directly experienced by a few chosen ambassadors. This contradiction may not be as irreconcilable as it appears, for Apollo was a unique artifact of its time. Millions of people witnessed the first landing of humans on another celestial body through their black-and-white TVs in the comfort of their homes. Such vicarious exploration had no precedent. If the import of Apollo was ultimately global, signaling human migration off the planet, then its immediate communicative power was ultimately largely private, in homes and offices.

Historically, many of those who advocated space exploration emphasized science as an important rationale for exploration. The literature on the history of space-based science has, however, not been significant. Several factors explain the weakness of a unified tradition of writing on space science history. These include the fragmentary nature of the field, where much of the work is generated from other history-of-science subdisciplines such as the history of physics, astronomy, life sciences, meteorology, and oceanography. The contributions in two volumes of essays separated by 10 years, *Space Science Comes of Age: Perspectives in the History of the Space Sciences* (1981) and *A Spacefaring Nation: Perspectives on American Space History and Policy* (1991), underline the difficult struggles of nascent space-based science constituencies (within solar science and planetary science) to escape the shadow of their parent communi-

22. Neil Armstrong, Michael Collins, and Edwin E. Aldrin, Jr., with Gene Farmer and Dora Jane Hamblin, *First on the Moon* (Boston: Little, Brown, and Company, 1970); Richard S. Lewis, *The Voyages of Apollo: The Exploration of the Moon* (New York: Quadrangle, 1974).

23. Andrew Chaikin, *A Man on the Moon: The Voyages of the Apollo Astronauts* (New York: Viking, 1994).

24. For media treatments of the space program, see Andrew A. Klyukovski, "The Space Race as the American Dream: Fantasy Theme Analysis of 'The New York Times' Coverage" (Ph.D. diss., University of Missouri-Columbia, 2002).

ties (physics and astronomy).[25] Additionally, science has traditionally played a secondary (if not tertiary) role in the American space program, behind political and military imperatives. For space historians who have chronicled the American space program as political, nationalistic, or technological enterprises, space science has been a corollary theme rather than a central one.[26] Two volumes of NASA's *Exploring the Unknown* series chronicling the history of American civilian space exploration are the most important contributions to space science history, but the editors' consignment of space sciences to volumes 5 and 6 in the series underscores the subfield's priority in the schematic of space history overall.[27] Finally, historians have frequently seen space science as deeply connected to rationales of militarization or exploration. As such, space science history remains embedded with these other narratives. For example, in his *Science with a Vengeance: How the Military Created the US Space Sciences after World War II* (1992), David DeVorkin argued that space science was created largely due to the existence of the German V-2 missile, a weapon of war whose development had nothing to do with either the search for scientific knowledge or exploration.[28]

25. Paul A. Hanle and Del Chamberlain, eds., *Space Science Comes of Age: Perspectives in the History of Space Sciences* (Washington, DC: Smithsonian Institution Press, 1981). See also Karl Hufbauer, "Solar Observational Capabilities and the Solar Physics Community Since Sputnik, 1957–1988"; Joseph N. Tatarewicz, "Space Technology and Planetary Science, 1950–1985," in *A Spacefaring Nation: Perspectives on American Space History and Policy*, eds. Martin J. Collins and Sylvia D. Fries (Washington, DC: Smithsonian Institution Press, 1991), pp. 77–114, 115–132.

26. Two important works on science performed during Apollo are framed as part of programmatic "mission-oriented" histories. See William David Compton, *Where No Man Has Gone Before: A History of Apollo Lunar Exploration Missions* (Washington, DC: NASA SP-4214, 1989); David M. Harland, *Exploring the Moon: The Apollo Expeditions* (London: Springer, 1999). A third, lesser-known but more accomplished work focuses exclusively on the science rather than the missions: Donald A. Beattie, *Taking Science to the Moon: Lunar Experiments and the Apollo Program* (Baltimore: Johns Hopkins, 2001).

27. See particularly the excellent introductory essays in John M. Logsdon, ed., *Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program*, vol. 5, *Exploring the Cosmos* (Washington, DC: NASA SP-2001-4407, 2001); John M. Logsdon et al., eds., *Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program*, vol. 6, *Space and Earth Science* (Washington, DC: NASA SP-2004-4407, 2004). For the few other notable works on the history of space science, see Charles A. Lundquist, *Skylab's Astronomy and Space Sciences* (Washington, DC: NASA, 1979); John A. Pitts, *The Human Factor: Biomedicine in the Manned Space Program to 1980* (Washington, DC: NASA SP-4213, 1985; John E. Naugle, *First Among Equals: The Selection of NASA Space Science Experiments* (Washington, DC: NASA SP-4215, 1991); David Leverington, *New Cosmic Horizons: Space Astronomy from the V-2 to the Hubble Space Telescope* (New York: Cambridge University Press, 2001).

28. David H. DeVorkin, *Science with a Vengeance: How the Military Created the US Space Sciences after World War II* (New York: Springer-Verlag, 1992); David H. DeVorkin, "Military Origins of the Space Sciences in the American V-2 Era," in *National Military Establishments and the Advancement of Science and Technology*, eds. Paul Forman and José M. Sánchez-Ron, Studies in Twentieth Century History (Boston: Kluwer Academic Publishers, 1996). See also DeVorkin's "Solar Physics," in *Exploring the Unknown*, vol. 6, pp. 1–37.

COMPETITION AND NATIONAL SECURITY

The exploration motif overlaps with a second theme running through the historiography of space exploration, that of competition. Richard Lewis, in his *From Vinland to Mars: A Thousand Years of Exploration* (1976), eloquently illustrated the ways in which competition over resources and land spurred exploration. He found a common imperative existing from the Greenland and Vinland voyages of the Viking Eric the Red all the way to the Viking spacecraft landings on Mars in the bicentennial year of 1976. Framing his narrative around this coincidence of names, Lewis focused on competition as a guiding metaphor for space exploration:

> The common denominator [in all exploration] is intraspecific competition . . . : deadly competition among men and families for land, among nations for power and wealth. This is the force that drove the have-nots in medieval Scandinavia across uncharted seas, impelled Renaissance Europe to seek the wealth of the Indies and circumnavigate the planet, urged Amundsen and Scott on the tragic race to the geographic south pole, and launched Americans to the Moon.[29]

Like Lewis, many space historians have used competition—specifically, the Cold War—as a second defining lens to understand space history. Most popular accounts of the space race, and many from an academic perspective, have framed the American adventure in space as competition with an adversary who did not share the same moral commitment to freedom and equality. In the canon, both Sputnik and Apollo emerge, at least implicitly, as material representations embedded with notions of two ideologically opposed systems of governance. To a large degree, such evaluations of Apollo reflected rhetoric from the 1960s—from American politicians, the American media, and from participants in the Apollo project itself. But because accounts of the space race have been typically undergirded by implicit claims about morality of national cultures, historians rarely engaged in critiques of Apollo or the space program in general, since such methodological approaches would be tantamount to challenging the moral authority of the United States. In his recent *Apollo: The Epic Journey to the Moon*, an engaging and awe-inspiring account of the Apollo project, David West Reynolds distills this rationale succinctly and emotionally:

29. Richard S. Lewis, *From Vinland to Mars: A Thousand Years of Exploration* (New York: Quandrangle, 1976), p. xii.

> [The Moon race] was a Cold War battle to demonstrate the superior ability of the superior system, capitalism versus communism . . . . And the battle did prove out the more capable system . . . . The reasons are many, but among them the power of free enterprise ranks high . . . . Free competition motivated American workers whose livelihoods were related to the quality and brilliance of their work, and we saw extraordinary, impossible things accomplished by ordinary Americans. The American flag on the Moon is such a powerful symbol because it is not a vain one. America, like no other nation, *was* capable of the Moon.[30]

Beyond linking Cold War competition to celebratory nationalistic impulses, others used competition to revisit seminal events in space history. John M. Logsdon's *The Decision to Go to the Moon: Project Apollo and the National Interest* (1970), the classic study of the original imperatives that gave rise to Apollo, was one of the earliest.[31] Kennedy's actual decision to go to the Moon stemmed from a series of politically inopportune precipitates, including the aborted Bay of Pigs invasion and Yuri Gagarin's historic first flight into space in April 1961. Keen to respond to the unending humiliations in the new space frontier, Kennedy enlisted the aid of Vice President Lyndon B. Johnson to formulate an ambitious but realistic response to the Soviets. By the end of May, after extensive consultations with their advisers, Kennedy and Johnson had their goal: send Americans to the Moon before the end of the decade, an announcement the President made to a joint session of Congress on 25 May 1961. By synthesizing the disparate threads of the events of 1961 using primary documentation, Logsdon laid the groundwork for understanding a seminal event in U.S. space policy and thus built the foundation for a new interpretive school of space history, space *policy* history.[32]

Cold War competition has loomed large in the vast subgenre of space policy history, and a number of works have sought to explain the twists and turns of American space policy through its interdependence with Cold War

30. David West Reynolds, *Apollo: The Epic Journey to the Moon* (New York: Tehabi, 2002), p. 257.

31. John M. Logsdon, *The Decision to Go to the Moon: Project Apollo and the National Interest* (Cambridge, MA: MIT Press, 1970).

32. For collections that include essays on the history of space policy, see Radford Byerly, Jr., ed., *Space Policy Reconsidered* (Boulder, CO: Westview Press, 1989); Radford Byerly, Jr., ed., *Space Policy Alternatives* (Boulder, CO: Westview Press, 1992); Roger D. Launius, ed., *Organizing for the Use of Space: Historical Perspectives on a Persistent Issue* (San Diego: Univelt, 1995); Eligar Sadeh, ed., *Space Politics and Policy: An Evolutionary Perspective* (Dordrecht, Netherlands: Kluwer Academic Publishers, 2003).

politics on an international scale.[33] The results of several history conferences in the 1980s—hosted by NASA and the National Air and Space Museum—broke new ground in the field of space policy history by going beyond the original Cold War competition dynamic.[34] A number of these papers departed from much of the early historiography by focusing on post-Apollo efforts including the space station *Freedom* and the Hubble Space Telescope. In exploring, for example, how NASA's Space Station Task Force convinced a lukewarm White House to support the original *Freedom* proposal in the early 1980s, Howard McCurdy highlighted the influence of government agencies over governmental policy.[35] Others explored the dynamics of space policy through specific presidential administrations, thus analyzing the causes why some space projects survive and others don't, depending on politics at the highest level.[36]

A number of space policy histories took an overtly critical stance to NASA and its mission, focusing often on the lack of foresight exhibited by policymakers and managers at NASA, the Congress, and the Executive Branch.[37] Amitai Etzioni's *The Moon Doggle: Domestic and International Implications of the Space Race* (1964), although not a history book, was one such early critique which called the entire enterprise of Apollo into doubt since he believed that

33. See, for example, William H. Schauer, *The Politics of Space: A Comparison of the Soviet and American Space Programs* (New York: Holmes & Meier Publishers, 1976); Xavier Pasco, *La Politique Spatiale des Etats-Unis: 1958–1995: Technologie, inérêt national et débat public* (Paris: L'Harmattan, 1997); Matthew J. Von Bencke, *The Politics of Space: A History of U.S.-Soviet/Russian Competition and Cooperation in Space* (Boulder, CO: Westview Press, 1997); Dale L. Hayden, *The International Development of Space and Its Impact on U.S. National Space Policy* (Maxwell AFB, AL: Airpower Research Institute, College of Aerospace Doctrine, Research and Education, Air University, 2004).

34. For the proceedings of the 1981 and 1987 conferences, see Hanle and Chamberlain, *Space Science Comes of Age*; Collins and Fries, *Spacefaring Nation*. The proceedings of a similar conference hosted by Yale University in 1981 were published as Alex Roland, ed., *A Spacefaring People: Perspectives on Early Spaceflight* (Washington, DC: NASA SP-4405, 1985).

35. Howard E. McCurdy, "The Space Station Decision: Politics, Bureaucracy, and the Making of Public Policy," in *Spacefaring Nation*, ed. Collins and Fries, pp. 9–28.

36. Linda T. Krug, *Presidential Perspectives on Space Exploration: Guiding Metaphors From Eisenhower to Bush* (New York: Praeger, 1991); Derek W. Eliott, "Finding an Appropriate Commitment: Space Policy Development Under Eisenhower and Kennedy, 1954–1963" (Ph.D. diss., George Washington University, 1992); Howard E. McCurdy, *The Space Station Decision: Incremental Politics and Technological Choice* (Baltimore: Johns Hopkins, 1990); Mark Damohn, *Back Down to Earth: The Development of Space Policy for NASA During the Jimmy Carter Administration* (San Jose, CA: Authors Choice Press, 2001).

37. Erik Bergaust, *Murder on Pad 34* (New York: Putnam, 1968); Erlend A. Kennan and Edmund H. Harvey, Jr., *Mission to the Moon: A Critical Reexamination of NASA and the Space Program* (New York: Morrow, 1969); Hugo Young, Brian Silcock, and Peter Dunn, *Journey to Tranquillity: The History of Man's Assault on the Moon* (London: Cape, 1969); Roger Handberg, *Reinventing NASA: Human Spaceflight, Bureaucracy and Politics* (Westport, CT: Praeger, 2003); Greg Klerkx, *Lost in Space: The Fall of NASA and the Dream of a New Space Age* (New York: Pantheon Books, 2004).

it represented a cynical public relations exercise diverting attention away from more pressing domestic issues such as the War on Poverty.[38]

Since the mid-1980s, a number of important works used the Cold War competition paradigm but focused specifically on national security programs, which constituted about half of all national expenditures on spaceflight yet received relatively little scrutiny from historians. The earliest academic work in this subfield was Paul B. Stares's *The Militarization of Space: U.S. Policy, 1945–1984* (1985), which examined the rise of the American space weapons program and its largely unrecorded but substantial influence over American military policy.[39] Writing during a time of extreme tension between the Soviet Union and the United States, Stares argued that the arms race was migrating to the arena of space by the mid-1980s. Equally groundbreaking was journalist William E. Burrows's *Deep Black: Space Espionage and National Security* (1986), in which he focused on the development of highly classified photoreconnaissance satellites which spy on other nations. Using anonymous sources and declassified materials, he wove a story of a secret world that in fact consumed a substantial share of the American space budget but whose very existence was never explicitly acknowledged by the U.S. government.[40]

The early work of Stares and Burrows was overshadowed by CIA-sponsored post–Cold War declassification initiatives. In 1995, the U.S. government revealed details of one of the biggest secrets of the Cold War, the United States' first operational spy satellite system, CORONA, whose satellites flew dozens of missions in the 1960s over secret targets in the Soviet Union, China, Vietnam, and elsewhere. If earlier writing on the genesis of the U.S. space effort emphasized civilian programs such as Vanguard and Explorer, the CORONA revelations helped to reframe the early years of the American space program as parallel and sometimes interconnected civilian and military

38. Amitai Etzioni, *The Moon Doggle: Domestic and International Implications of the Space Race* (Garden City, NY: Doubleday, 1964). For other contemporary works, see Edwin Diamond, *The Rise and Fall of the Space Age* (Garden City, NY: Doubleday, 1964); Vernon van Dyke, *Pride and Power: The Rationale of the Space Program* (Urbana: University of Illinois Press, 1964).

39. Paul B. Stares, *The Militarization of Space: U.S. Policy, 1945–1984* (Ithaca: Cornell University Press, 1985). I differentiate here between military space programs and intelligence space programs, both of which fall under national security programs. The former include weapons development, while the latter include reconnaissance satellites. The earliest open work to explore the American military and intelligence space programs was Phillip Klass's *Secret Sentries in Space* (New York: Random House, 1971). Anthony Kenden was another pioneering scholar in the field. See his "U.S. Reconnaissance Satellite Program," *Journal of the British Interplanetary Society* (July 1978), and "A New U.S. Military Space Mission," *Journal of the British Interplanetary Society* (October 1982).

40. William E. Burrows, *Deep Black: Space Espionage and National Security* (New York: Berkley Books, 1986). For a Cold War–era look at space weaponization, see Curtis Peebles, *Battle for Space* (Dorset, U.K.: Blandford, 1983). Another important contribution in the pre-CORONA-revelation era was Jeffrey T. Richelson's *America's Secret Eyes in Space: The U.S. Keyhole Spy Satellite Program* (New York: Harper & Row, 1990).

projects. Where civilian efforts, especially the human spaceflight program, had assumed center stage in the historiography, CORONA highlighted how much of the old history had told only half the story. The CIA's first deputy director for science and technology, Albert D. "Bud" Wheelon, who managed the CORONA program in the mid-1960s, wrote in *Eye in the Sky: The Story of the CORONA Spy Satellites* (1998):

> When the American government eventually reveals the full range of reconnaissance systems developed by this nation, the public will learn of space achievements every bit as impressive as the Apollo moon landings. One program proceeded in utmost secrecy, the other on national television. One steadied the resolve of the American public; the other steadied the resolve of American presidents.[41]

Photoreconnaissance satellite programs such as CORONA and its successors, such as the KH-9 HEXAGON and KH-11 KENNAN, consumed a lion's share of the U.S. "black" space program and, in fact, drove much of early U.S. space policy. Historical details of other important programmatic elements of American national security projects, such as early-warning systems, signals intelligence, military communications, meteorology, navigation, antisatellite, and (abandoned) human military spaceflight projects, have come to light owing to the research of several historians including R. Cargill Hall, Jeffrey T. Richelson, and Dwayne A. Day, whose works represented a major shift in the scholarship on military space programs, moving from speculative works based on rumor, leaks, and analysis of orbital parameters to using primary documentation.[42] Day's work has been particularly groundbreaking, opening up previ-

41. Albert D. Wheelon, "CORONA: A Triumph of American Technology," in *Eye in the Sky: The Story of the CORONA Spy Satellites*, ed. Dwayne A. Day et al. (Washington, DC: Smithsonian Institution Press, 1998), p. 38.

42. For a discussion of early warning, see Jeffrey T. Richelson, *America's Space Sentinels: DSP Satellites and National Security* (Lawrence: University Press of Kansas, 1999); R. Cargill Hall, "Missile Defense Alarm: The Genesis of Space-Based Infrared Early Warning," *Quest: The History of Spaceflight Quarterly* 7, no. 1 (1999): 5–17. For naval strategy and military space programs, see Norman Friedman, *Seapower and Space: From the Dawn of the Missile Age to Net-Centric Warfare* (Annapolis, MD: Naval Institute Press, 2000). For manned military programs, see Roy F. Houchin II's "Why the Air Force Proposed the Dyna-Soar X-20 Program" and "Why the Dyna-Soar X-20 Program Was Cancelled," both in *Quest: The History of Spaceflight Magazine* 3, no. 4 (1994): 5–12 and 35–37, respectively; Steven R. Strom, "The Best Laid Plans: A History of the Manned Orbiting Laboratory," *Crosslink* 5, no. 2 (2004): 11–15. For weather satellite programs, see Dwayne A. Day, "Dark Clouds: The Classified Origins of the Defense Meteorological Satellite Program," *Spaceflight* 43 (2001): 382–385; R. Cargill Hall, "A History of the Military Polar Orbiting Meteorological Satellite Program," *Quest: The History of Spaceflight Quarterly* 9, no. 2 (2002): 4–25. For navigation satellites, see Bradford W. Parkinson et al., "A History of Satellite Navigation," *Navigation: Journal*

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ously hidden aspects of geodetic, signals intelligence, and photoreconnaissance satellite projects.[43] His recent work on the Air Force's interest in developing a dual human space capsule and reconnaissance satellite in the late 1950s adds to our understanding of the motivations and strategies institutions used to achieve specific goals in the early days of space exploration.[44]

This substantive (and generational) shift in scholarship, made possible by post–Cold War declassifications, has allowed the study of American military space history to focus on questions common to the study of American military history and intelligence collection, such as civil-military relations, interservice and interorganizational rivalry, and the relationship between technological development and mission requirements. Day, for example, produced important scholarship on the uses of satellite intelligence in monitoring the supersecret Soviet human lunar landing project in the 1960s, thus illuminating the hitherto unknown ways in which the civilian NASA interacted with the intelligence community.[45] Richelson's groundbreaking *The Wizards of Langley* (2001), a history of the CIA's Directorate of Science and Technology which developed and deployed both photoreconnaissance and signals intelligence systems during the Cold War, also exemplifies this new generation. Weaving

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of the Institute of Navigation 42, no. 1, special issue (1995): 109–164; Chris Banther, "A Look into the History of American Satellite Navigation," *Quest: The History of Spaceflight Quarterly* 11, no. 3 (2004): 40–48. For antisatellite projects, see Wayne R. Austerman, *Program 437: The Air Force's First Antisatellite System* (Peterson AFB, CO: Office of History, 1991); Dwayne A. Day, "Arming the High Frontier," *Spaceflight* 46 (2004): 467–471. For organizational histories, see Harold M. Sapolsky, *Science and the Navy: The History of the Office of Naval Research* (Princeton: Princeton University Press, 1990); David N. Spires, *Beyond Horizons: A Half Century of Air Force Space Leadership* (Peterson AFB: Air Force Space Command, 1997); James Bamford, *Body of Secrets: Anatomy of the Ultra-Secret National Security Agency* (New York: Anchor Books, 2001); Jeffrey T. Richelson, *The Wizards of Langley: Inside the CIA's Directorate of Science and Technology* (Boulder, CO: Westview Press, 2001). For command and control, see David C. Arnold, *Spying from Space: Constructing America's Satellite Command and Control Systems* (College Station: Texas A&M University Press, 2005).

43. Day has published a series of articles on these topics. For geodetic projects, see "Mapping the Dark Side of the World: Part 1: The KH-5 ARGON Geodetic Satellite" and "Mapping the Dark Side of the World: Part 2: Secret Geodetic Programmes after ARGON," both in *Spaceflight* 40 (1998): 264–269 and 303–310, respectively. For signals intelligence satellites, see "Tinker, Tailor, Radar, Spy: Early American Ferret and Radar Satellites," *Spaceflight* 43 (2001): 288–293; "Ferrets Above: American Signals Intelligence Satellites During the 1960s," *International Journal of Intelligence and Counterintelligence* 17, no. 3 (2004): 449–467. For photoreconnaissance, see "A Sheep in Wolf's Clothing: The Samos E-5 Recoverable Satellite, Part 1," *Spaceflight* 44 (2002): 424–431; "A Square Peg in a Cone-Shaped Hole: The Samos E-5 Recoverable Satellite, Part 2," *Spaceflight* 45 (2003): 71–79; "From Cameras to Monkeys to Men: The Samos E-5 Recoverable Satellite, Part 3," *Spaceflight* 45 (2003): 380–389.

44. Day, "From Cameras to Monkeys to Men."

45. Dwayne A. Day and Asif A. Siddiqi, "The Moon in the Crosshairs: CIA Intelligence on the Soviet Manned Lunar Programme," *Spaceflight* 45 (2003): 466–475 and 46 (2004): 112–125; Dwayne A. Day, "From the Shadows to the Stars: James Webb's Use of Intelligence Data in the Race to the Moon," *Air Power History* 51, no. 4 (winter 2004): 30–39. See also Roger D. Launius, "NASA Looks to the East: American Intelligence Estimates of Soviet Capabilities and Project Apollo," *Air Power History* (fall 2001): 5–15.

an intricate story of various projects that "represented a quantum leap in U.S. intelligence capabilities," he locates the development of these systems in a broader context involving relationships with influential scientists outside the agency, the necessity to fill gaps in intelligence collection, and the connections between satellite development and intelligence production.[46]

The two most important works on CORONA, Day et al.'s *Eye in the Sky* and McDonald's *CORONA*, included contributions from individuals who participated in CORONA development in the late 1950s and early 1960s; as such, they can be characterized as semiofficial histories.[47] Both unequivocally extolled the technological, managerial, and operational successes of the project. Its history was framed as part of a singularly powerful story about the efficacy of good management and high technology to benefit the national interest of the United States, which was synonymous with engendering peace and freedom abroad. Writing about CORONA's use in monitoring compliance with arms control agreements, historian Ernest R. May concluded his essay by suggesting that "probably . . . the best one-line epitaph for CORONA would read: 'It helped keep peace in the nuclear age'."[48]

The end of the Cold War—specifically the collapse of the Soviet empire—validated, to some degree, the moral ground for historians writing of American military space programs. The writing on CORONA echoed a powerful strand of post-1991 historiography of the Cold War in general, which celebrated American motives over ideologically and morally suspect Soviet intentions. The post–Cold War self-congratulatory climate insulated the history of CORONA or other U.S. military space programs from critiques of their relationship to the Cold War military-industrial complex or

46. Richelson, *Wizards of Langley*, p. 287. For a poor example of the "new" history—on the understudied topic of intelligence analysis—see David T. Lindgren, *Trust But Verify: Imagery Analysis in the Cold War* (Annapolis, MD: Naval Institute Press, 2000). For civil-military interactions, see John Cloud, "Imaging the World in a Barrel: CORONA and the Clandestine Convergence of the Earth Sciences," *Social Studies of Science* 31, no. 2 (2001): 231–251; John Cloud, "Re-Viewing the Earth: Remote Sensing and Cold War Clandestine Knowledge Production," *Quest: The History of Spaceflight Quarterly* 8, no. 2 (2001): 4–16; Ronald E. Doel, "Constituting the Postwar Earth Sciences: The Military's Influence on the Environmental Sciences in USA After 1945," *Social Studies of Science* 33, no. 5 (2003): 635–666.

47. Day et al., *Eye in the Sky*; Robert McDonald, ed., *CORONA: Between the Sun & the Earth: The First NRO Reconnaissance Eye in Space* (Bethesda, MD: American Society for Photogrammetry and Remote Sensing, 1997). For derivative works based on the above, see Curtis Peebles, *The Corona Project: America's First Spy Satellites* (Annapolis, MD: Naval Institute Press, 1997); Philip Taubman, *Secret Empire: Eisenhower, the CIA, and the Hidden Story of America's Space Espionage* (New York: Simon & Schuster, 2003). For an overview of the literature on CORONA, see Dwayne A. Day, "Rashomon in Space: A Short Review of Official Spy Satellite Histories," *Quest: The History of Spaceflight Quarterly* 8, no. 2 (2000): 45–53.

48. Ernest R. May, "Strategic Intelligence and U.S. Security: The Contributions of CORONA," in *Eye in the Sky*, p. 28.

as part of American interventionist aims in global conflicts played out in the developing world (in, for example, Southeast Asia and Central America).[49]

While the contextual touchstone of U.S. military space history is the Cold War, the literature has remained woefully disconnected from many of the broader intellectual debates that have characterized the historiography of the Cold War through the past 40 years and now in the post–Cold War era. Beginning with the historians who defended the policy of containment against expansionist Soviet intentions, to the generation of revisionists who argued the left-liberal position that American economic interests on a global level contributed to the Cold War, to the postrevisionists who emphasized misperception and misunderstanding to explain much of the Cold War, the canon has passed through many transformations.[50] From the 1980s, and especially in the post–Cold War period, several new threads emerged as diplomatic, social, and cultural historians contributed richly to understanding not only international relations, but also domestic American cultural currents that formed part of the mosaic of the country's trajectory through the Cold War. For example, a new generation of historians is now looking at how domestic culture affected foreign policy.[51]

In terms of international competition—the principal context for the origins of the American space program—the biggest public splash was made by John Lewis Gaddis's *We Know Now: Rethinking Cold War History* (1997), which harked back to the original view that Stalin's personality, Soviet authoritarianism, and communist ideology were principal reasons for the Cold War.[52]

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49. For a rare example on the strategic dimension of space support during wartime, see Henry W. Brandli, "The Use of Meteorological Satellites in Southeast Asia Operations," *Aerospace Historian* 29, no. 3 (1982): 172–175.

50. For useful summaries of the enormous transformations in Cold War historiography, see Melvyn P. Leffler, "The Cold War: What Do 'We Know Now'?" *American Historical Review* 104, no. 2 (1999): 501–524; Timothy J. White, "Cold War Historiography: New Evidence Behind Traditional Typographies," *International Social Science Review* 1, no. 1 (fall–winter 2000).

51. David Campbell, *Writing Security: United States Foreign Policy and the Politics of Identity* (Minneapolis: University of Minnesota Press, 1992); Brenda Gayle Plummer, *Rising Wind: Black Americans and U.S. Foreign Affairs, 1935–1960* (Chapel Hill: University of North Carolina Press, 1996); Akira Iriye, *Cultural Internationalism and World Order* (Baltimore: Johns Hopkins, 1997); Frank Costigliola, "'Unceasing Pressure for Penetration': Gender, Pathology, and Emotion in George Kennan's Formation of the Cold War," *Journal of American History* 84 (1997): 1309–1339; Robert D. Dean, "Masculinity as Ideology," *Diplomatic History* 22 (1998): 29–62.

52. John Lewis Gaddis, *We Know Now: Rethinking Cold War History* (Oxford: Clarendon Press, 1997). See also Gaddis, "Rethinking Cold War History: A Roundtable Discussion," in *At the End of the American Century: America's Role in the Post–Cold War World*, ed. Robert L. Hutchins (Baltimore: Johns Hopkins, 1998), pp. 52–66; Douglas J. Macdonald, "Communist Bloc Expansion in the Early Cold War: Challenging Realism, Refuting Revisionism," *International Security* 20 (1995–1996): 152–188. For similar perspectives on the Soviet side, see Vladislav Zubok and Constantine Pleshakov, *Inside the Kremlin's Cold War: From Stalin to Khrushchev* (Cambridge, MA: Harvard University Press, 1996); Vojtech Mastny, *The Cold War and Soviet Insecurity: The Stalin Years* (New York: Oxford University Press, 1996).

Gaddis's arguments were countered by many who emphasized and explored ideology on both sides, the organization of overseas propaganda by both governments, transnational global relations, the relationship between military capabilities and diplomatic policies, the end of colonialism, and conflicts played out between "strong" and "weak" powers.[53] Military space historians whose objects of study are firmly embedded in the Cold War have yet to evolve through these larger debates. The recent works on CORONA, for example, implicitly and closely follow the "Gaddis school," remaining disconnected from equally compelling but entirely different narratives of the history of the Cold War.[54] In *The Devil We Knew: Americans and the Cold War* (1993), respected diplomatic historian H. W. Brands argued that the battle with the Soviet Union served a spectrum of psychological, economic, strategic, and political imperatives. He claimed that the United States subverted some of the nation's best principles to win the Cold War. Thus any proclaimed victory was, at best, ambiguous.[55] How does the success of CORONA fit into such thinking? We may have much to learn from an exploration of this question.

ARTIFACTUAL AND PROGRAMMATIC HISTORIES

Beyond exploration and competition, a third large body of space history represents history centered on artifacts and/or programs. Willy Ley's early works—as well as those of David Lasser, Chas G. Philp, and P. E. Cleator—pioneered the artifact-centered history by merging the canon of popular science with popular history.[56] This school focused mainly on explaining how particu-

53. See for example, Thomas Borstelmann, *Apartheid's Reluctant Uncle: The United States and Southern Africa in the Early Cold War* (New York: Oxford University Press, 1993); Robert J. McMahon, *The Cold War on the Periphery: The United States, India, and Pakistan* (New York: Columbia University Press, 1994); David Holloway, *Stalin and the Bomb: The Soviet Union and Atomic Energy, 1939–1954* (New Haven, CT: Yale University Press, 1994); Thomas Risse-Kappen, *Cooperation Among Democracies: The European Influence on U.S. Foreign Policy* (Princeton, NJ: Princeton University Press, 1995); Ilya Gaiduk, *The Soviet Union and the Vietnam War* (Chicago: I. R. Dee, 1996); Steven J. Zaloga, *The Kremlin's Nuclear Sword: The Rise and Fall of Russia's Strategic Nuclear Forces, 1945–2000* (Washington, DC: Smithsonian Institution Press, 2002).

54. For a balanced view of American military space policy within the broader international context, see Michael E. O'Hanlon, *Neither Star Wars nor Sanctuary: Constraining the Military Uses of Space* (Washington, DC: The Brookings Institution, 2004). The few explicit critiques of the U.S. military space program, unfortunately, have been shrill and largely without value. See, for example, Jack Manno, *Arming the Heavens: The Hidden Military Agenda for Space, 1945–1995* (New York: Dodd, Mead, & Co., 1984); Loring Wirbel, *Star Wars: US Tools of Space Supremacy* (London: Pluto Press, 2004).

55. H. W. Brands, *The Devil We Knew: Americans and the Cold War* (New York: Oxford University Press, 1993).

56. David Lasser, *The Conquest of Space* (New York: The Penguin Press, 1931); Chas G. Philp, *Stratosphere and Rocket Flight (Astronautics)* (London: Sir Isaac Pitman & Sons, Ltd., 1935); P. E. Cleator, *Rockets Through Space: The Dawn of Interplanetary Travel* (New York: Simon & Schuster, 1936).

lar technologies worked, how they were developed, how they were tested, and finally, how they behaved during operational flights. De Witt Douglas Kilgore, in his recent *Astrofuturism: Science, Race, and Visions of Utopia in Space* (2003), calls the authors of this subgenre "scientists, engineers, and writers [who were] public apologists for the value of science."[57] Their works, grounded in scientific laws and mathematics, were not only accounts of past technological developments, but also contained narratives about the immense potential of engineers and managers to solve engineering problems; on a fundamental level, they are narratives about the "myth of [technological] progress."[58]

The programmatic histories typically encompass an arc from the conception of the project (the first chapter) to the final successful mission (the last) while maintaining a perspective that renders extraprogrammatic perspectives invisible. By rejecting contingency and context and embracing narratives of chronology and progress, they represent the distillation of teleology and Whiggish notions in space history.[59] The central actors in programmatic histories have typically been the artifact—the rocket engine, the launch vehicle, the spacecraft, and the ground complex. Such a focus reflects the organizational approach of the early American space program, where any new space technologies—such as liquid-hydrogen propulsion technology, for example—were developed under discrete NASA programs (in this case, Centaur).[60] As a result, programmatic histories have been frequently indistinguishable from artifactual histories.

Building on the tradition of Ley, Lasser, and others, beginning in the 1960s and continuing to the present, the NASA History Office has produced a series of works that have focused on particular programs. Although these studies were largely divorced from broader political, social, or cultural concerns, they served as important foundations for future historians to study how and why particular technologies emerged and how states and institutions arbitrate over questions of technology and management. An exemplary and excellent first step in the field was *The History of Rocket Technology: Essays on Research, Development, and Utility* (1964), a collection of essays on the development of ballistic missiles and spacecraft by a number of important architects

57. De Witt Douglas Kilgore, *Astrofuturism: Science, Race, and Visions of Utopia in Space* (Philadelphia: University of Pennsylvania Press, 2003).

58. For a critique of the "myth of progress" in the history of technology, see John Staudenmaier, *Technology's Storytellers: Reweaving the Human Fabric* (Cambridge, MA: MIT Press, 1985).

59. The term "Whig history" originally comes from Herbert Butterfield's *The Whig Interpretation of History* (London: G. Bell and Sons, 1931), where, in his examination of British constitutional history, he found a historical canon that framed history from a presentist stance without taking into account the viewpoints prevailing during the times of the figures under study. His was also an early critique of narratives centered on the "march of progress."

60. For Centaur, see Virginia P. Dawson and Mark D. Bowles, *Taming Liquid Hydrogen: The Centaur Upper Stage Rocket, 1958–2002* (Washington, DC: NASA SP-2004-4230, 2004).

of the U.S. rocketry and space program, including Walter R. Dornberger, Frank J. Malina, and Wernher von Braun. In his preface, then–NASA Chief Historian Eugene M. Emme argued that rocket technology was of fundamental importance to Western society, in effect restating the Cold War paradigm but linking it to the development of modern science and technology: "The eminence of Western science and technology—and all that this means, including but also beyond the connotations of national power—is not a little dependent upon the short and long-term success of technological progress in rocketry and astronautics."[61] All of these essays reflected prevailing interpretive trends in the relatively new field of history of technology, whose practitioners were fascinated with inventors, their inventions, and the effect of these inventions on society. In other words, these histories approached technology through deterministic and unidirectional perspectives where technology had profoundly impacted societies; the possibility of a reverse relationship was left unexplored. In his introduction to the 1964 volume, Emme encapsulated this view, suggesting that "rocketry has influenced the entire structure and conduct of national and international politics and economics."[62]

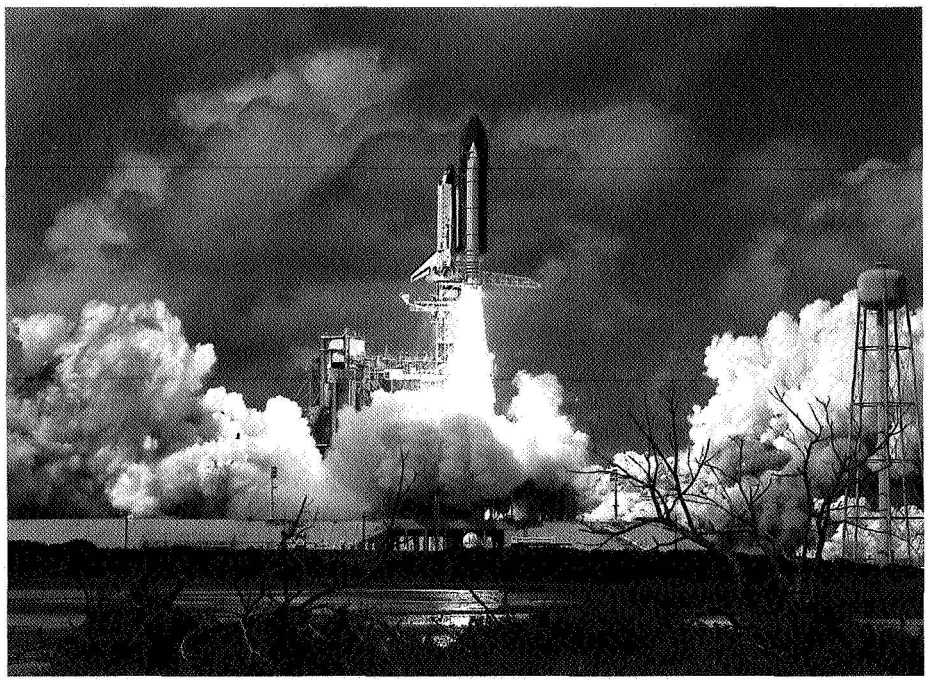
Since the Emme volume, NASA has sponsored numerous works in the canon, many of which have contributed to recording and chronicling important aspects of the country's efforts to explore space. The biggest subgroup—on human spaceflight—includes Swenson, Grimwood, and Alexander's *This New Ocean: A History of Project Mercury* (1966); Hacker and Grimwood's *On the Shoulders of Titans: A History of Project Gemini* (1977); Benson and Faherty's *Moonport: A History of Apollo Launch Facilities and Operations* (1978); Brooks, Grimwood, and Swenson's *Chariots for Apollo: A History of Manned Lunar Spacecraft* (1979); Compton and Benson's *Living and Working in Space: A History of Skylab* (1983); and Compton's *Where No Man Has Gone Before: A History of Apollo Lunar Exploration Missions* (1989).[63] Other NASA or NASA-sponsored books have focused on robotic missions, including NASA's extraordinarily successful and impressive deep space and interplanetary programs.[64] A recent work,

61. Eugene M. Emme, ed., *The History of Rocket Technology: Essays on Research, Development, and Utility* (Detroit: Wayne State University Press, 1964), p. 1.

62. Emme, *History of Rocket Technology*, p. 1.

63. Loyd S. Swenson, Jr., et al., *This New Ocean: A History of Project Mercury* (Washington, DC: NASA SP-4201, 1966); Barton C. Hacker and James C. Grimwood, *On the Shoulders of Titans: A History of Project Gemini* (Washington, DC: NASA SP-4203, 1977); Charles D. Benson and William Barnaby Faherty, *Moonport: A History of Apollo Launch Facilities and Operations* (Washington, DC: NASA SP-4204, 1978); Courtney G. Brooks et al., *Chariots for Apollo: A History of Manned Lunar Spacecraft* (Washington, DC: NASA SP-4205, 1979); W. David Compton and Charles D. Benson, *Living and Working in Space: A History of Skylab* (Washington, DC: NASA SP-4208, 1983); Compton, *Where No Man Has Gone Before.*

64. Richard Fimmel et al., *Pioneer Odyssey* (Washington, DC: NASA SP-394/396, 1977); Henry C. Dethloff and Ronald A. Schorn, *Voyager's Grand Tour: To The Outer Planets and Beyond* (Washington, DC: Smithsonian Institution Press, 2003).



No aspect of space travel is more exciting or has received greater historical attention than the human component. Too many observers, however, are too enthralled with the spectacle of flight to probe the history of the activity deeply. Here is the Return to Flight launch of Space Shuttle *Discovery* and its five-man crew from Pad 39B at 11:37 a.m., 29 September 1988, as *Discovery* embarked on a mission of 4 days and 1 hour. *(NASA image no. 88PC-1001)*

To Reach the High Frontier: The History of U.S. Launch Vehicles (2002), updated Emme's earlier seminal work by adding a number of essays on the technological development of the major American satellite launchers derived from Cold War–era warhorses such as the Atlas and Titan ICBMs.[65] The book was a timely update on the history of efforts to develop efficient access to space.

Beyond NASA, unofficial historians have devoted an enormous amount of ink and paper to the early American human spaceflight program. These works, which exploded in number in the late 1990s and the first decade of the 21st century, represent the perfectly idealized form of the programmatic and artifactual history. Many of the artifactual histories, such as Dennis Jenkins's

65. Roger D. Launius and Dennis R. Jenkins, eds., *To Reach the High Frontier: A History of U.S. Launch Vehicles* (Lexington: University Press of Kentucky, 2002). See also the essays on launch vehicles and access to space in John M. Logsdon et al., eds., *Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program*, vol. 4, *Accessing Space* (Washington, DC: NASA SP-4407, 1999).

Space Shuttle: The History of the National Space Transportation System: The First 100 Missions (2001), comprise extremely thorough and informative narratives, providing an engineer's perspective on the many technical decisions during design, testing, and operations of particular projects.[66] Because of their distance from the original events, the prevailing context of a directionless American space program, and perceptions of American greatness compromised by liberals and social programs, these works communicate not only nostalgia, but also regret.[67] In *Leaving Earth* (2003), Robert Zimmerman notes, "Can we no longer imagine a future where humanity goes out and settles the far-flung stars? Have we become so small-minded that we cannot envision a tomorrow as idealistic and hopeful as that imagined by men like Ley, Korolev, and von Braun?"[68]

Histories of robotic exploration have been less mired in the betrayal of the post-Apollo times. Like their human spaceflight counterparts, they are coherent and useful accounts of humanity's first efforts to probe beyond circumterrestrial space. There exist comprehensive and technically detailed histories of Voyager, Galileo, Ulysses, and Mars Pathfinder, as well as broader histories of lunar and planetary exploration.[69] As part of its *Exploring the Unknown* series, NASA has also sponsored studies on scientific research by robotic probes.[70] The study of applications satellites (communications, weather, remote sensing, etc.) remains relatively neglected within the space history community, because it lacks the cachet of both human and deep space exploration, in part

66. Dennis R. Jenkins, *Space Shuttle: The History of the National Space Transportation System: The First 100 Missions* (Cape Canaveral, FL: D. R. Jenkins, 2001). See also Richard S. Lewis, *The Voyages of Columbia: The First True Spaceship* (New York: Columbia University Press, 1984).

67. See, for example, Robert Zimmerman, *Genesis: The Story of Apollo 8: The First Manned Flight to Another World* (New York: Four Walls Eight Windows, 1998); Harland, *Exploring the Moon*; John Catchpole, *Project Mercury: NASA's First Manned Space Programme* (London: Springer, 2001); David Shayler, *Gemini: Steps to the Moon* (London: Springer, 2001); David Shayler, *Skylab: America's Space Station* (London: Springer, 2001); David Shayler, *Apollo: The Lost and Forgotten Missions* (London: Springer, 2002); Reynolds, *Apollo*; Reginald Turnill, *The Moonlandings: An Eyewitness Account* (Cambridge, U.K.: Cambridge University Press, 2003).

68. Zimmerman, *Leaving Earth*, p. 463.

69. Henry S. F. Cooper, Jr., *Imaging Saturn: The Voyager Flights to Saturn* (New York: Holt, Rinehart, and Winston, 1982); Murray, *Journey into Space*; Burrows, *Exploring Space*; Robert Reeves, *The Superpower Space Race: An Explosive Rivalry Through the Solar System* (New York: Plenum Press, 1994); Donna Shirley and Danelle Morton, *Managing Martians* (New York: Broadway Books, 1998); Robert S. Kraemer, *Beyond the Moon: A Golden Age of Planetary Exploration, 1971–1978* (Washington, DC: Smithsonian Institution Press, 2000); David M. Harland, *Jupiter Odyssey: The Story of NASA's Galileo Mission* (London: Springer, 2000); Judith Reeves-Stevens et al., *Going to Mars: The Untold Story of Mars Pathfinder and NASA's Bold New Missions for the 21st Century* (New York: Pocket Books, 2000); David M. Harland, *Mission to Saturn: Cassini and the Huygens Probe* (London: Springer, 2002); Andrew Mishkin, *Sojourner: An Insider's View of the Pathfinder Mission* (New York: Berkeley Books, 2003); Paolo Ulivi, *Lunar Exploration: Human Pioneers and Robotic Surveyors* (London: Springer-Verlag, 2003); Ben Evans with David M. Harland, *NASA's Voyager Missions: Exploring the Outer Solar System and Beyond* (London: Springer, 2004).

70. Logsdon et al., *Exploring the Unknown*, vol. 5.

because these satellites carry no people and go nowhere. In contrast to human and deep space robotic spaceflight, the services offered by applications satellite systems deeply shape social, political, and cultural dimensions of societies. The objectives, capabilities, and design of such systems are in turn profoundly shaped by social, political, and cultural needs. Although many such "civilian" technological systems developed from firm connections with military projects, few historians have produced scholarship on their origins, performance, and ramifications.[71]

A number of historians and journalists have explored aspects of the many large-scale technological systems that were part of the American space program. These include management-focused histories such as Arnold S. Levine's *Managing NASA in the Apollo Era* (1982) and Stephen B. Johnson's *The Secret of Apollo: Systems Management in American and European Space Programs* (2002).[72] Two biographical works have enriched our understanding of the success of Apollo: Henry W. Lambright's *Powering Apollo: James E. Webb of NASA* (1995) and Robert C. Seamans's *Aiming at Targets: The Autobiography of Robert C. Seamans* (1996).[73] Both Webb and Seamans played critical roles in facilitating one of the most impressive and largest technological systems in 20th-century America. Their own words will be crucial for future historians interested in relocating Apollo in the same kind of social, political, and cultural context that Thomas P. Hughes did for electrical systems in his landmark *Networks of Power* (1983).[74]

T. A. Heppenheimer's multivolume history of the Space Shuttle is an important contribution to the programmatic space history genre. Although it

71. For the few works on applications projects, see Pamela E. Mack, *Viewing the Earth: The Social Construction of the Landsat System* (Cambridge, MA: MIT Press, 1990); David J. Whalen, *The Origins of Satellite Communications, 1945–1965* (Washington, DC: Smithsonian Institution Press, 2002); Donald H. Martin, *Communications Satellites*, 4th ed. (El Segundo, CA: Aerospace Press, 2000); Donna A. Demac, ed., *Tracing New Orbits: Cooperation and Competition in Global Satellite Development* (New York: Columbia University Press, 1986); P. Krishna Rao, *Evolution of the Weather Satellite Program in the U.S. Department of Commerce: A Brief Outline* (Washington, DC: NOAA, 2001); James M. Allen and Shanaka de Silva, "Landsat: An Integrated History," *Quest: The History of Spaceflight Quarterly* 12, no. 1 (2005): 6–22. See also the essays on satellite communications and remote sensing in John M. Logsdon et al., *Exploring the Unknown: Selected Documents in the History of the U.S. Civilian Space Program*, vol. 3, *Using Space* (Washington, DC: NASA SP-4407, 1998).

72. Arnold S. Levine, *Managing NASA in the Apollo Era* (Washington, DC: NASA SP-4102, 1982); Stephen B. Johnson, *The Secret of Apollo: Systems Management in American and European Space Programs* (Baltimore, MD: Johns Hopkins, 2002).

73. Henry W. Lambright, *Powering Apollo: James E. Webb of NASA* (Baltimore, MD: Johns Hopkins, 1995); Robert C. Seamans, *Aiming at Targets: The Autobiography of Robert C. Seamans* (Washington, DC: NASA SP-4106, 1996). See also the essays by Seamans, Webb, and other Apollo-era NASA managers, including Robert R. Gilruth, Wernher von Braun, George M. Low, Rocco A. Petrone, Samuel C. Phillips, and George E. Mueller, in *Apollo Expeditions to the Moon*, ed. Cortright.

74. Thomas P. Hughes, *Networks of Power: Electrification in Western Society, 1880–1930* (Baltimore: Johns Hopkins, 1983).

skirts social issues and references no literature from the academic historiography of American technology, it represents a fleshed-out narrative that expertly describes the interplay between politics and technology that affected key milestones in the Shuttle program, including the requirements for such a system and how those requirements evolved over time depending on claims made by constituencies within NASA and the Department of Defense.[75] Similarly, Roger D. Launius's *Space Stations: Base Camps to the Stars* (2003) looks thematically at the historical development of space stations and their central role in the evolution of both prescriptive and practical plans for the exploration of space, entrenched partly by what Dwayne A. Day has called the dominant "von Braun" paradigm of space exploration.[76]

NOSE CONE HISTORY

The astronaut memoir (or, more broadly, the astronaut-centered history) constitutes one of the largest historical subgenres in the field of space history. I call these works "nose cone histories" since they describe a narrowly circumscribed circle of events visible only to the astronauts and in which only the astronauts were visible. For the millions who followed the space program in the 1960s, astronauts—not engineers nor servicepersons nor managers—were the most visible human representations of the technological accomplishments of the early Space Age. Our natural urge to distill all the meaning of the space program—in particular its avatar Apollo—was embodied potently by the astronauts. As Tom Wolfe described in *The Right Stuff* (1979), these young, able, athletic, and short-haired men each seemed an idealized version of an American everyman, with a wife, a picket fence, a shiny car—and yet simultaneously wrapped in myth and mystery.[77]

Some of the nose cone histories have added important dimensions of the story of the American human spaceflight program. For example, Apollo 11 astronaut Michael Collins, in his fascinating memoir *Carrying the Fire: An Astronaut's Journeys* (1974), shows a deep empathy and understanding of the role of astronauts in the halcyon days leading up to the epic Moon landing in 1969. Collins's narrative provided the first glimpse behind the iconogra-

75. T. A. Heppenheimer, *The Space Shuttle Decision: NASA's Search for a Reusable Space Vehicle* (Washington, DC: NASA SP-4221, 1999); Heppenheimer, *Development of the Space Shuttle, 1972–1981* (Washington, DC: Smithsonian Institution Press, 2002).

76. Launius, *Space Stations*. See also the equally fine Giovanni Caprara, *Living in Space: From Science Fiction to the International Space Station* (Willowdale, Ontario: Firefly Books, 2000). Less successful is Zimmerman's *Leaving Earth*, which is a sprawling and flawed attempt to locate the development of space stations in domestic and international politics. For the "von Braun paradigm," see Dwayne A. Day, "The Von Braun Paradigm," *Space Times* 33 (November–December 1994): 12–15.

77. Tom Wolfe, *The Right Stuff* (New York: Farrar, Straus and Giroux, 1979).

phy of the astronaut-as-unidimensional-hero of popular American culture, a self-sustaining myth given birth after the "original seven" Mercury astronauts were presented to the American media in 1959.[78] Collins described his colleagues as a complex group with diverse personality traits spanning the whole gamut: overachieving, academic, adventurous, risk-averse, emotionally distant, publicity-seeking, insecure, and brilliant. All were fully ready to do the job they were given. Further astronaut memoirs, particularly Walt Cunningham's *All-American Boys* (1977) and Gene Cernan's *The Last Man on the Moon* (1999), were, like Collins's pioneering work, candid about the singularly unique experiences of the NASA astronauts of the 1960s, especially their relationship to top management, their competitiveness among themselves, and their often complicated private lives.[79] Astronaut Donald "Deke" Slayton, the man responsible for selecting every American space crew between 1965 and 1975, added important historical details to how astronaut crews were picked—including Armstrong and Aldrin for the first lunar landing—in his posthumously published memoir, *Deke! An Autobiography* (1995).[80]

Fully fleshed, well-researched, and contextual biographies can say something profound not just about an individual, but also the period under study; yet most nose cone space histories have been narrow, hagiographic, or self-serving. They reinforce rather than explore the mythmaking associated with the astronaut as icon. They also continue to marginalize the many thousands who also worked on the space program; in other words, fetishization of the astronaut has been a potent barrier against a social history of the space program since, in the popular consciousness, the history of the American space program remains inseparable from the biographies and heroism of astronauts.[81]

78. Michael Collins, *Carrying the Fire: An Astronaut's Journeys* (New York: Farrar, Straus and Giroux, 1974). Soon after their selection in 1959, the original seven astronauts signed deals with *Life* magazine for exclusive rights to bring their lives to the public. Apart from the many *Life* stories, one major output of this agreement was the very clinical book by W. Scott Carpenter et al., *We Seven, By the Astronauts Themselves* (New York: Simon & Schuster, 1962).

79. Walt Cunningham with Mickey Herskowitz, *The All-American Boys* (New York: Macmillan, 1977); Eugene A. Cernan and Donald A. Davis, *The Last Man on the Moon: Astronaut Eugene Cernan and America's Race in Space* (New York: St. Martin's Press, 1999).

80. Donald K. "Deke" Slayton and Michael Cassutt, *Deke! An Autobiography* (New York: St. Martin's Press, 1995). See also Joseph D. Atkinson, Jr., and Jay M. Shafritz's *The Real Stuff: A History of NASA's Astronaut Recruitment Program* (New York: Praeger, 1985) for a more academic perspective on astronaut selection.

81. Important exceptions to the bland astronaut-centered histories include two works by Henry S. F. Cooper: *Before Liftoff: The Making of a Space Shuttle Crew* (Baltimore: Johns Hopkins, 1987) and *A House in Space* (New York: Holt, Rinehart, and Winston, 1976). The former is an excellent study on the dynamics of forming and training crews for human spaceflight, while the latter explores the interactions of crew members on the long-duration *Skylab* missions. Jim Hansen's biography of Neil Armstrong, *First Man: The Life of Neil A. Armstrong* (New York: Simon & Schuster, forthcoming) also promises to be an important contribution to the field.

A new generation of space enthusiasts (affectionately called "space cadets" by some) has taken up the job of producing a slew of astronaut biographies. The first few published in the 1980s and 1990s provided unique viewpoints to the history of the American human space program, but by the early 2000s, their utility as history texts has diminished.[82] Many astronauts continue to write their own memoirs, usually ghost-written with others. The memoirs of some would suggest that travel through space engendered profound spiritual transformations—or often crises of the spirit—that led them to unexpected pathways.[83] The ones who achieved important management or advisory positions in the space program—such as Gemini and Apollo astronaut Thomas P. Stafford—have more to say than others. But all ponder, explore, and frequently advocate specific policies to give direction to a space program evidently lacking one since the golden age of Apollo.[84]

NEW HISTORY

In an article in 2000, then–NASA Chief Historian Roger D. Launius identified a "New Aerospace History" that emerged in the 1980s that was

82. See, for example, Colin Foale, *Waystation to the Stars: The Story of Mir, Michael, and Me* (London: Headline, 1999); Evelyn Husband with Donna Van Liere, *High Calling: The Courageous Life and Faith of Space Shuttle Commander Rick Husband* (Nashville, TN: Thomas Nelson, 2003); Colin Burgess et al., *Fallen Astronauts: Heroes Who Died Reaching the Moon* (Lincoln: University of Nebraska Press, 2003); Ray E. Boomhower, *Gus Grissom: The Lost Astronaut* (Indianapolis: Indiana Historical Society Press, 2004); Neal Thompson, *Light This Candle: The Life & Times of Alan Shepard—America's First Spaceman* (New York: Crown Publishers, 2004); Leon Wagener, *One Giant Leap: Neil Armstrong's Stellar American Journey* (New York: Forge, 2004); Nancy Conrad and Howie Klausner, *Rocketman: Astronaut Pete Conrad's Incredible Ride to the Moon and Beyond* (New York: New American Library, 2005).

83. Edwin E. Aldrin, Jr., with Wayne Warga, *Return to Earth* (New York: Random House, 1973); James Irwin and Williams Emerson Irwin, *To Rule the Night* (Philadelphia: A. J. Holman, 1973); Kathleen Maughn Lind, *Don Lind: Mormon Astronaut* (Salt Lake City: Deseret Book, 1985); Charlie Duke and Dotty Duke, *Moonwalker* (Nashville: Oliver-Nelson Books, 1990); Edgar D. Mitchell, *The Way of the Explorer: An Apollo Astronaut's Journey Through the Material and Mystical Worlds* (New York: G. P. Putnam's Sons, 1996); Gordon Cooper and Bruce Henderson, *Leap of Faith: An Astronaut's Journey into the Unknown* (New York: Harper Collins, 2000).

84. Armstrong et al., *First on the Moon*; Frank Borman with Robert J. Serling, *Countdown: An Autobiography* (New York: W. Morrow, 1988); Wally Schirra and Richard N. Billings, *Schirra's Space* (Boston: Quinlan Press, 1988); Jim Lovell and Kluger Jeffrey, *Lost Moon: The Perilous Voyage of Apollo 13* (Boston: Houghton Mifflin, 1994); Mike R. Mullane, *Liftoff! An Astronaut's Dream* (Parsippany, NJ: Silver Burdett Press, 1995); Bill Nelson with Jamie Buckingham, *Mission: An American Congressman's Voyage to Space* (San Diego: Harcourt Brace Jovanovich, 1988); Alan Bean with Andrew Chaikin, *Apollo: An Eyewitness Account by an Astronaut* (Shelton, CT: Greenwich Workshop Press, 1998); John Glenn and Nick Taylor, *John Glenn: A Memoir* (New York: Bantam Books, 1999); Jerry Linenger, *Off the Planet: Surviving Five Perilous Months Aboard the Space Station Mir* (New York: McGraw-Hill, 2000); Scott Carpenter, *For Spacious Skies: The Uncommon Journey of a Mercury Astronaut* (Orlando, FL: Harcourt, 2002); Thomas P. Stafford and Michael Cassutt, *We Have Capture: Tom Stafford and the Space Race* (Washington, DC: Smithsonian Institution Press, 2002).

"intrinsically committed to relating the subject to larger issues of society, politics, and culture and taking a more sophisticated view," a history that "move[d] beyond a fetish for the artifact."[85] More generally, Launius characterized these works as being in the middle ground between critique and celebration of the space program. I would modify Launius's typology by expanding the parameters to include a wider range of intellectual inquiry that often includes *both* critiques and celebration of the space program. They are, however, distinguished from the more traditional canon in two important ways: first, they do not rely on singular approaches to interpreting the history of space exploration, such as exploration, competition, technology, and astronauts. Instead, these works combine different elements of each and firmly locate their narratives in broader political, social, technological, and/or cultural contexts; i.e., they function as political, social, technological, and/or cultural histories. Second, they attempt to link to other historical subdisciplines such as the history of the Cold War, diplomatic history, and the history of science and technology.

In analyzing the new history, I describe important examples from each of four categories of new history—political, social, technological, and cultural history—and summarize opportunities for future research in each subgenre.

Political History

In the new history, political history has led the way in important reevaluations of the American space program. Walter A. McDougall's Pulitzer Prize–winning . . . *The Heavens and the Earth: A Political History of the Space Age* (1985) remains the most important and influential work in the genre. The book contributed to relocating the early years of the American space program in the broader context of postwar American politics. McDougall's main argument was that after World War II, and especially after Sputnik, the U.S. government marshaled resources on an unprecedented scale to promote advancements in science and technology, in effect, transforming the country into a new kind of 20th-century state, the technocracy. He noted:

> In those years [of the Sputnik challenge] the fundamental relationship between the government and new technology changed as never before in history. No longer did state and society react to new tools and methods, adjusting, regulating, or encouraging their spontaneous development. Rather, states took upon themselves the primary responsibility for generating new technology. This has meant that to the extent revolution-

85. Launius, "The Historical Dimension of Space Exploration," p. 23.

> ary technologies have profound second-order consequences in the domestic life of societies, by forcing new technologies, *all* governments have become revolutionary, whatever their reasons or ideological pretensions.[86]

In McDougall's formulation, the rise of a postwar technocracy was inseparable from the rise of the national security state, since federal policies on science and technology—especially after Sputnik—were closely related to countering the perceived intellectual and military power of the Soviet Union. McDougall's overarching thesis substantively redefined the way in which historians viewed the space program. If they had previously resorted to invoking the "natural" human urge to explore, technological fetishization, or international competition, his work redirected attention to a magnitude of changes on the domestic political and institutional stage associated with the origins of the space program.

McDougall also argued that the Eisenhower administration's concerns over establishing a "freedom of space" rationale guided its initial formulations of American space policy. According to McDougall, neither the White House nor the Department of Defense emphasized a policy of being first to launch an artificial satellite of the Earth; instead, national security considerations—such as establishing the "freedom of space" precedent, developing a military space program under the cover of a civilian one, and not diverting resources from the concurrent ICBM program—trumped any drive to beat the Soviets. McDougall's work challenged readers to reevaluate the ingrained notion of the Eisenhower administration's space policy as confused and ineffectual.[87] Besides facilitating a shift in the tone of historical scholarship on American space exploration, . . . *The Heavens and the Earth*'s Pulitzer Prize validated historical scholarship on the space program as worthy of serious academic study.

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86. Walter A. McDougall, . . . *The Heavens and the Earth: A Political History of the Space Age* (New York: Basic Books, 1985), pp. 6–7, emphasis in original.

87. Stephen E. Ambrose, in his multivolume biography of President Eisenhower, was the first to reframe the Eisenhower administration's role in the origins of the U.S. space program, but McDougall fully developed the idea. See Stephen E. Ambrose, *Eisenhower*, vol. 2, *The President* (New York: Simon & Schuster, 1983). The reevaluation of the Eisenhower administration's role in early U.S. space policy was fleshed out further in Rip Bulkeley, *The Sputniks Crisis and Early United States Policy: A Critique of the Historiography of Space* (Bloomington: Indiana University Press, 1991). For pathbreaking research on the "freedom of space" issue, see also Dwayne A. Day, "New Revelations about the American Satellite Programme Before Sputnik," *Spaceflight* 36 (1994): 372–373; R. Cargill Hall, "Origins of U.S. Space Policy: Eisenhower, Open Skies, and Freedom of Space," in *Exploring The Unknown: Selected Documents in the History of the U.S. Civil Space Program*, ed. John M. Logsdon et al., vol. 1, *Organizing for Exploration* (Washington, DC: NASA SP-4407, 1995), pp. 213–229; Dwayne A. Day, "Cover Stories and Hidden Agendas: Early American Space and National Security Policy," in *Reconsidering Sputnik: Forty Years Since the Soviet Satellite*, ed. Roger D. Launius et al. (Amsterdam: Harwood Academic Publishers, 2000), pp. 161–195.

Following in the footsteps of . . . *The Heavens and the Earth*, innovative scholarship by space policy scholar Howard E. McCurdy and historian Roger D. Launius advanced a reinterpretation of the "golden age" of Apollo at a 1993 symposium on presidential leadership and its influence on U.S. space policy. Instead of seeing Apollo as a "normal" stage in the evolution of American space policy, several historians argued that "the Apollo decision was . . . an anomaly in the history of the U.S. space program."[88] The implication was that policy-makers of the future could not use Apollo as a model of how to explore space since Apollo was intrinsically a unique product of its time that existed only because of exceptional circumstances, primarily national prestige and Cold War competition. Although this was not a new viewpoint, for the first time, space historians placed this notion as the key to understanding the early direction of American space exploration. In the conference proceedings, published as *Spaceflight and the Myth of Presidential Leadership* (1997), historians also argued that the role of presidential leadership in general may have been overestimated by advocates of space exploration after the Kennedy era. Recent reexaminations of Kennedy's historical 1961 decision to go to the Moon bolstered such a contrasting perspective.[89]

A 1997 conference on the 40th anniversary of Sputnik provided an opportunity for new and exciting scholarship on the origins and repercussions of the early American and Soviet space programs. Using recently declassified documents, historians amplified a number of important topics, including the "freedom of space" rationale for the beginning of the American space program, the selection of the Vanguard satellite project as the first civilian program, the formulation of the National Aeronautics and Space Act that led to the formation of NASA, and the effects of the National Defense Education Act that fundamentally altered the role of science and engineering in higher education in the United States. The collected papers from this conference, published as *Reconsidering Sputnik: Forty Years Since the Soviet Satellite* (2000), remain the most important set of intellectual inquiries into the origins of the American space program, complementing Robert Divine's systematic study of the Eisenhower administration's response to Sputnik, *The Sputnik*

88. Roger D. Launius and Howard E. McCurdy, eds., *Spaceflight and the Myth of Presidential Leadership* (Urbana: University of Illinois Press, 1997), p. 9. See also W. D. Kay, *Can Democracies Fly in Space? The Challenge of Revitalizing the U.S. Space Program* (Westport, CT: Praeger, 1995).

89. See also James L. Kauffman, *Selling Outer Space: Kennedy, the Media, and Funding for Project Apollo, 1961–1963* (Tuscaloosa: University of Alabama Press, 1994); Michael R. Beschloss, "Kennedy and the Decision to Go to the Moon" in *Spaceflight and the Myth of Presidential Leadership*, pp. 51–67; Stephen J. Garber, "Multiple Means to an End: A Reexamination of President Kennedy's Decision to Go to the Moon," *Quest: The History of Spaceflight Quarterly* 7, no. 2 (1999): 5–17; Andrew Chaikin, "White House Tapes Shed Light on JFK Space Race Legend," *Space.com*, 22 August 2001, *http://www.space.com/news/kennedy_tapes_010822.html*; Roger D. Launius, "Kennedy's Space Policy Reconsidered: A Post-Cold War Perspective," *Air Power History* 50, no. 4 (2003): 16–29.

Challenge (1993).[90] Similar reevaluations have been focused on other presidential administrations and their positions on initiatives within the civilian space program.[91]

The new political history suggests six broad areas ripe for future scholarship. These include the following:

1) Revisiting the early American space program in light of the complex debates within the canon of Cold War history, including studies of the space program as an adjunct for the less savory dimensions of American foreign policy; additionally, historians could explore not only how the Cold War shaped the contours of the civilian and military space programs, but also how the latter shaped aspects of the former; Giles Alston's dissertation on the influence of Apollo on international relations points to further avenues of research.[92]

2) Further study of the ways in which different administrations have used specific initiatives and programs as part of political agendas unrelated to the stated goals of the initiatives or programs;[93] surprisingly, there exist no systematic studies of the Nixon or Reagan administration's stance towards civilian and military space policy.

90. Launius et al., *Reconsidering Sputnik*; Robert A. Divine, *The Sputnik Challenge: Eisenhower's Response to the Soviet Satellite* (New York: Oxford University Press, 1993); Lafayette P. Temple III, "Organizing Space: The Political-Bureaucratic Dynamics Through 1961" (Ph.D. diss., George Washington University, 1999). See also Matt Bille and Erika Lishock, *The First Space Race: Launching the World's First Satellites* (College Station: Texas A&M University, 2004), which assembled all the new research into a single volume; Roger D. Launius, "Eisenhower, Sputnik, and the Creation of NASA: Technological Elites and Public Policy Agenda," *Prologue* 28 (summer 1996): 127–143; Peter J. Roman, *Eisenhower and the Missile Gap* (Ithaca, NY: Cornell University Press, 1995).

91. McCurdy, *The Space Station Decision*; Mark Damohn, *Back Down to Earth*; Krug, *Presidential Perspectives on Space Exploration*; Thor Nels Hogan, "Mars Wars: A Case History of Agenda Setting and Alternative Generation in the American Space Program" (Ph.D. diss., Public Policy and Public Administration Department, George Washington University, 2004). In addition, Launius and McCurdy's *Spaceflight and the Myth of Presidential Leadership* includes a number of important essays on Eisenhower, Kennedy, Johnson, Reagan, and George H. W. Bush.

92. Giles Alston, "International Prestige and the American Space Programme" (Ph.D. diss., Queen's University of Belfast, 1989).

93. For some examples, see Dwayne A. Day, "Space Policy-Making in the White House: The Early Years of the National Aeronautics and Space Council," in *Organizing for the Use of Space*, ed. Launius, pp. 117–154; Joan Hoff, "The Presidency, Congress, and the Deceleration of the U.S. Space Program in the 1970s," and Robert H. Ferrell, "Presidential Leadership and International Aspects of the Space Program," both in *Spaceflight and the Myth of Presidential Leadership*, ed. Launius and McCurdy, pp. 92–132 and 172–204, respectively. For a comparative study of NASA under two different administrations, see John D. Kelley, "An Organizational History of the National Aeronautics and Space Administration: A Critical Comparison of Administrative Decision Making in Two Pivotal Eras" (Ph.D. diss., University of Southern California, 2002).

3) The relationship, exchanges, and competition between the civilian and military/intelligence space programs, in terms of intelligence, hardware, and managerial and engineering expertise;[94] for example, how does the movement of high administrators (such as Dan Goldin and Michael Griffin) from one sector affect NASA policies?

4) The connections between foreign policy and domestic space policy, a vast topic which has been studied piecemeal, but not in any systematic and long *durée* approach.

5) The relationship between domestic political transactions (congressional politics, redistricting, lobbying, policy papers, advisory boards, etc.) and the making of space policy.

6) The role of institutions in the making of civilian and military space policy; the scholarship would encompass the study of why certain institutions are created, others are dissolved, what kind of inertia they carry through their history, and the ways in which particular institutions relate to others.

History of Technology

The second broad field of new history has emerged from within the bounds of the history of technology. Most artifactual histories of space programs tend to accept implicitly notions of technological determinism, especially that the space program exists as autonomous technology, affecting society around it but not being affected by it. There have been many works on the societal impacts of space exploration;[95] the field of space exploration has, however, largely been insulated from the paradigmatic revolution in the history of

94. For general perspectives, see Dwayne A. Day, "Invitation to Struggle: The History of Civilian-Military Relations in Space," in *Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program*, ed. John M. Logsdon, vol. 2, *External Relations* (Washington, DC: NASA SP-4407, 1996), pp. 233–270; Mark A. Erickson, "The Evolution of the NASA-DoD Relationship from Sputnik to the Lunar Landing" (Ph.D. diss., George Washington University, 1997). For exchanges of hardware between "black" and civilian space projects, see Dwayne A. Day's "Not So Black and White: the Military and the Hubble Space Telescope," *Space Times* 34 (March–April 1995): 20–21, and "From Above the Iron Curtain to Around the Moon," *Spaceflight* 47 (2005): 66–71. For an excellent work on the relationships between private industry, government-funded intelligence satellite programs, and technological innovation, see Jonathan E. Lewis, *Spy Capitalism: Itek and the CIA* (New Haven, CT: Yale University Press, 2002).

95. See, for example, Lillian A. Levy, ed., *Space, Its Impact on Man and Society* (New York: Norton, 1965); Raymond A. Bauer et al., *Second-Order Consequences: A Methodological Essay on the Impact of Technology* (Cambridge, MA: MIT Press, 1969); Charles P. Boyle, *Space Among Us: Some Effects of Space Research on Society* (Washington, DC: AIAA, 1974); Tim Greve et al., eds., *The Impact of Space Science on Mankind* (New York: Plenum Press, 1976).

technology in the 1980s that redirected focus from technological determinism to the social construction of technology (and technological systems).[96] A few notable exceptions include Pamela E. Mack's *Viewing the Earth: The Social Construction of the Landsat System* (1990) and Donald A. Mackenzie's *Inventing Accuracy: A Historical Sociology of Nuclear Missile Guidance* (1990).[97] In the latter, Mackenzie argued that missile accuracy was not an inevitable consequence of technical change, but rather part of a process involving negotiation between a wide range of actors. His use of missile guidance as a window into exploring how accuracy was socially constructed suggests important future avenues of further research on the space program, including studies of the ways in which crew safety, mission success, or risk assessments in the human space program have been negotiated and socially constructed.

The social constructivist approach is to some degree related to the influential shift in the literature on technological systems. In moving the study of the history of technology from artifacts to systems, historian Thomas P. Hughes's work fundamentally altered the ways in which historians conceived of the relationship between technology and society.[98] Tentative steps towards a view of space projects as large-scale technological systems were taken in important works such as R. Cargill Hall's *Lunar Impact: A History of Project Ranger* (1977) and Roger E. Bilstein's *Stages to Saturn: A Technological History of the Apollo/Saturn Launch Vehicles* (1980).[99] Similarly, Charles Murray and Catherine Bly Cox's excellent *Apollo: The Race to the Moon* (1989) describes the Apollo project as a system whose primary actors were managers, engineers, politicians, and organizations rather than astronauts. Based on documentation and interviews with the remaining living actors of the endeavor, their reconstruction of the Apollo project as a milestone in the history of management makes it probably the single best historical overview of Apollo.[100]

Beyond social constructivism, others have begun the work of looking at the space program as a case study in technological culture. In *Goals in Space:*

96. For seminal early works on the social construction of technology, see Wiebe J. Bijker et al., eds., *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology* (Cambridge, MA: MIT Press, 1987); Wiebe J. Bijker, *Of Bicycles, Bakelites, and Bulbs: Toward a Theory of Sociotechnical Change* (Cambridge, MA: MIT Press, 1995); Merritt Roe Smith and Leo Marx, eds., *Does Technology Drive History? The Dilemma of Technological Determinism* (Cambridge, MA: MIT Press, 1994).

97. Mack, *Viewing the Earth*; Donald A. Mackenzie, *Inventing Accuracy: A Historical Sociology of Nuclear Missile Guidance* (Cambridge, MA: MIT Press, 1990).

98. Hughes, *Networks of Power*; Thomas P. Hughes, *Rescuing Prometheus* (New York: Pantheon Books, 1998).

99. R. Cargill Hall, *Lunar Impact: A History of Project Ranger* (Washington, DC: NASA SP-4210, 1977); Roger E. Bilstein, *Stages to Saturn: A Technological History of the Apollo/Saturn Launch Vehicles* (Washington, DC: NASA SP-4206, 1980).

100. Charles Murray and Catherine Bly Cox, *Apollo: Race to the Moon* (New York: Simon & Schuster, 1989).

American Values and the Future of Technology (1991), William Sims Bainbridge used sociological methods to investigate how actors in American culture have used language in popular discussions on space exploration. On the institutional and organizational side, Diane Vaughan, in *The Challenger Launch Decision: Risky Technology, Culture, and Deviance at NASA* (1996), used interdisciplinary approaches derived from sociology and communications theory to analyze the culture of NASA in the 1980s.[101] Her research illustrates the ways in which organizations develop their own culture that, depending on the scarcity of resources, fosters an environment that finds high risk acceptable without breaking any major rules. Her conception of the "normalization of deviance" suggests important avenues of further research, especially for studying space projects that did not achieve any significant successes.[102]

Others have explored more esoteric approaches to the technological history of the space program. In *The Religion of Technology* (1997), David F. Noble investigates the role of scripture and definable Christian symbolism in the "dreaming" for space exploration in the pre-Sputnik days and the invocation of God as a transcendental element in the rhetoric of modern-day managers, activists, and astronauts.[103] If not all of his ruminations are convincing, his findings on the prehistory of space travel suggest as-yet-unexplored opportunities for scholarship on the relationship between religion and spaceflight in the early 20th century, furthered recently by Roger D. Launius in a meditation on utopianism and space advocacy.[104] David E. Nye, in his essay "Don't Fly Me to the Moon: The Public and the Apollo Space Program," also contributes to the move away from technological determinism. He challenges the near-sacred notions among the "space cadet" community that the history of space exploration was of any significance in the history of humanity; he also questions the notion that "experiencing outer space transformed inner consciousness," a claim which hinged on the images of a fragile Earth as seen from deep space by the Apollo astronauts. He concludes that retrospect has made Apollo a unifying memory when in reality, during its execution, the polity and populace remained fractured over its symbolic and material benefits. He concludes, "Just as all Americans revere their Revolution, even though less than half the population actively supported it in 1776, the Apollo Program appears to be gaining sanctity in retrospect."[105]

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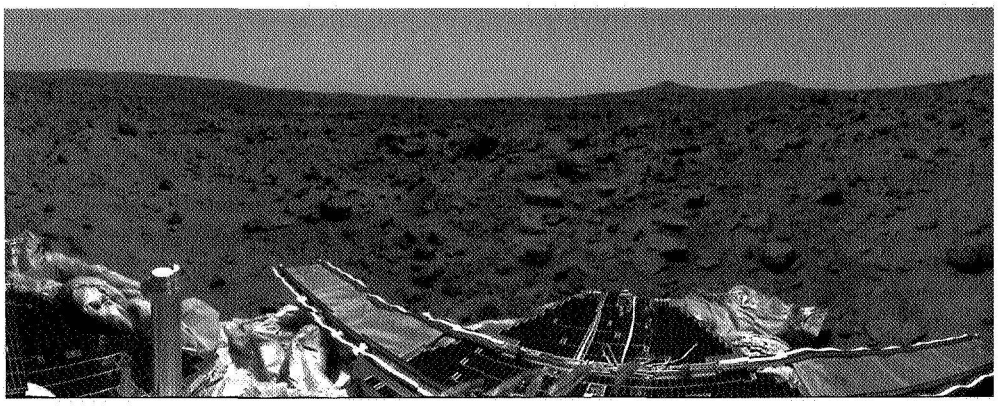
101. Diane Vaughan, *Challenger Launch Decision: Risky Technology, Culture, and Deviance at NASA* (Chicago: University of Chicago Press, 1996).

102. Vaughan's analysis, of course, also influenced the work of the Columbia Accident Investigation Board.

103. David F. Noble, *The Religion of Technology: The Divinity of Man and the Spirit of Invention* (New York: Alfred A. Knopf, 1997), pp. 115–142.

104. Launius, "Perfect Worlds, Perfect Societies."

105. David E. Nye, *Narratives and Spaces: Technology and the Construction of American Culture* (New York: Columbia University Press, 1997), p. 160.



Robotic spaceflight has yielded significant new understandings about the solar system. This is the first contiguous, uniform, 360-degree color panorama taken by the Imager for Mars Pathfinder (IMP) over the course of sols 8, 9, and 10 (Martian days) in 1997. Different regions were imaged at different times over the three Martian days

These new works underscore that, collectively, historians need to move beyond methodological approaches that embrace technological determinism, Whiggish history, and program-centered histories. They suggest six areas for further research:

1) Despite nearly 40 years of writing space history, we still do not have a substantive history of space technology, work focused not on programs but on the technologies that constitute a complete system capable of spaceflight, including rocket engines, solar cells, fuel cells, communications equipment, thermal protection, guidance systems, materials, etc.[106] We need histories that are neither programmatic nor artifact-centered; for example, a history of satellite-based optical systems (cameras, lenses, mirrors, data recovery, etc.) could shed light on the relationship between a particular technology, commercial industry, or the military and the way in which consumers can shape technologies.

2) An important but unexplored aspect of the space industry is the economic history of space manufacturing—in particular of rockets, engines, and satellites, which would illuminate issues of government-industry relations, quality control, and labor practices; it is also

106. For works on discrete technologies, see Lillian D. Kozloski, *U.S. Space Gear: Outfitting the Astronaut* (Washington, DC: Smithsonian Institution Press, 1993); Eldon C. Hall, *Journey to the Moon: The History of the Apollo Guidance Computer* (Reston, VA: AIAA, 1996); Gary L. Harris, *The Origins and Technology of the Advanced Extravehicular Space Suit* (San Diego, CA: Univelt, 2001); James A. Dewar, *To the End of the Solar System: The Story of the Nuclear Rocket* (Lexington: University of Kentucky Press, 2004).

to acquire consistent lighting and shadow conditions for all areas of the panorama. At left is a lander petal and a metallic mast that is a portion of the low-gain antenna. Deflated air bags are visible at the perimeters of all three lander petals. *(NASA image no. PIA00752)*

necessary to locate this history within the broader history of mass production in America.[107]

3) Journalists have devoted much attention to the various disasters of the Space Age, but besides one significant exception—David Shayler's *Disasters in Manned Spaceflight* (2000)—they have been focused narrowly on particular incidents.[108] Because the literature on space history has had a triumphalist arc (introduction, plot thickens, crisis, triumph over adversity), it has ignored accounts of long-range technological failures, which can also shed light on abandoned lineages of technologies and the contingencies that shaped our adoption of certain systems over others.[109]

107. For mass production in general, see David A. Hounshell's seminal *From the American System to Mass Production* (Baltimore: Johns Hopkins, 1984). For a brief essay on the economics of the space program, see Henry R. Hertzfeld, "Space as an Investment in Economic Growth," in *Exploring the Unknown*, ed. Logsdon, vol. 3, pp. 385–400.

108. David Shayler, *Disasters and Accidents in Manned Spaceflight* (New York: Springer, 2000). For various disaster-focused works, see Henry S. F. Cooper, *Thirteen, the Flight That Failed* (New York: Dial Press, 1972); Malcolm McConnell, *Challenger: A Major Malfunction* (Garden City, NY: Doubleday, 1987); Joseph Trento, *Prescription for Disaster* (New York: Crown, 1987); Richard S. Lewis, *Challenger: The Final Voyage* (New York: Columbia University Press, 1988); Claus Jensen and Barbara Haveland, *No Downlink: A Dramatic Narrative about the Challenger Accident and Our Time* (New York: Farrar, Straus and Giroux, 1996); Michael Cabbage and William Harwood, *Comm Check: The Final Flight of Shuttle Columbia* (New York: Free Press, 2004).

109. For technological failure, see Neil Schlager, ed., *When Technology Fails: Significant Technological Disasters, Accidents and Failures of the Twentieth Century* (Detroit: Gale Research, 1994); Azriel Lorber, *Misguided Weapons: Technological Failure and Surprise on the Battlefield* (Washington, DC: Brasseys, 2002).

4) The social constructivist approach remains a powerful methodological tool for in-depth studies of any number of rocket and spaceflight systems, including, for example, the Space Shuttle, which is an excellent case for studying how different actors can shape the form and function of a technological system; such an approach would help to avoid the deterministic historical narratives that assume, for example, that the liquid-propellant rocket was the obvious method to reach space without questioning the social and cultural forces that led Tsiolkovskiy, Goddard, Oberth, and others to arrive at the rocket as the propulsive force for access to space.

5) A relatively unexplored area is the social construction of risk in space technological systems; for example, we know little in a systematic way about the manner in which risk has been constructed, defined, and invoked in human versus robotic systems, in different human spaceflight programs, among engineers and flight directors, etc. An important unexplored question remains the historical evolution of what it means to "man-rate" a vehicle.

6) We still do not have well-researched histories on the continuing tension between robotic and human spaceflight; specific areas of inquiry could include the interplay between technology, policy, and organizational culture in determining choices for robotic versus human spaceflight; what role economics plays in these choices; and the ways in which we measure "output" for given space projects (whether human or robotic) and how these evaluations may or may not be contingent upon premiums placed upon human or robotic spaceflight. Finally, a useful avenue of research may be to explore why and how, during the early space era (especially in the pre-Sputnik years), policy-makers overwhelmingly emphasized human spaceflight in their public advocacy.

Social History

Beyond political history, several historians and sociologists have taken up the job of moving beyond nose cone history into broader social themes. An early progenitor of this subgenre was William S. Bainbridge's *The Spaceflight Revolution: A Sociological Study* (1976). Although his focus was primarily on spaceflight visionaries from the late 19th and early 20th centuries, Bainbridge argued that the advancement of technology was not necessarily deterministic. In fact, in cases of revolutionary technology such as the rocket, the principal actors (such as von Braun) maneuvered the government and military into facilitating resources to implement their goals of spaceflight. Thus, instead of

being co-opted by the state, scientists and engineers opportunistically took advantage of the state.[110]

Historians have also investigated a number of methodological issues related to the study of the early space program, including the problem of doing contemporary or near-contemporary history. Because of the recent nature of the history of space exploration, participants can play a large role in the way space history is chronicled. Participants provide evidence for historians, write history books, and sometimes dismiss nonparticipant history with a "you-weren't-there" rationale; historians respond by condescending to the participants by invoking "that noble dream" of objectivity and distance.[111] Space historians must explicitly address these methodological concerns if their goal is to produce history without baggage.

Beyond methodological concerns, an important aspect of the social dimension of spaceflight has been the relationship between public opinion and the space program. Mark E. Byrnes, in his *Politics and Space: Image Making by NASA* (1994), traced the effects of NASA's image-building policy on popular perceptions of the organization as well as broader support for the cause of space travel. He argued that NASA primarily used three images—nationalism, romanticism, and pragmatism—to create and consolidate political support across the nation for its major endeavors in space.[112] Similar work by others has helped to challenge many accepted notions about public advocacy for the space program. Using quantitative data, for example, Herbert E. Krugman found that "given the extensive media coverage of the space events throughout [the Apollo program], favorable publicity did not seem to have generated equally favorable public support for the Apollo program."[113] Roger D. Launius found that popular support for the space program remained at the same relative level both during and after the Apollo program, undercutting the received notion

110. William S. Bainbridge, *The Spaceflight Revolution: A Sociological Study* (New York: Wiley, 1976).

111. For a history of the search for objectivity in the discipline of history in American academia, see Peter Novick's *That Noble Dream: The 'Objectivity Question' and the American Historical Profession* (Cambridge, U.K.: Cambridge University Press, 1988). For some of the methodological considerations in writing space history, see Joseph N. Tatarewicz, "Writing the History of Space Science and Technology: Multiple Audiences with Divergent Goals and Standards," in *The Historiography of Contemporary Science and Technology*, ed. Thomas Söderqvist (Amsterdam: Harwood Academic Publishers, 1997), pp. 71–89.

112. Mark E. Byrnes, *Politics and Space: Image Making by NASA* (Westport, CT: Praeger, 1994). See also James L. Kauffman, *Selling Outer Space: Kennedy, the Media, and Funding for Project Apollo, 1961–1963* (Tuscaloosa: University of Alabama Press, 1994); Lynn Marie Disbrow, "A Metaphorical Analysis of the Evolution of NASA's Public Image, 1962–1986" (Ph.D. diss., Wayne State University, 1989).

113. Herbert E. Krugman, "Public Attitudes Toward the Apollo Space Program, 1965–1975," *Journal of Communication* 27, no. 4 (1977): 87–93.

of a "golden age" of mass support for the space program.[114] Expanding the frontier on social histories of the Space Age, recent studies have also focused on hitherto unexplored but crucial elements of the history of spaceflight such as the pro-space movement, the impact of the space program on geographical locales, and engineers as a mass demographic.[115]

Beyond these important exceptions, social history, which revolutionized mainstream American history beginning in the 1960s, has not made many inroads into space history. I identify five areas for further study concerning the relationship between society and space:

1) The history of the space program remains incomplete unless we explore the lived experiences and backgrounds of large demographic groups such as engineers, servicemen and -women, military and intelligence personnel involved in programs, launch personnel, staff workers, spouses and families of engineers in both the civilian and military space programs, etc.

2) Further exploration is necessary on the relationship between public advocacy and political commitment in the context of the space program, extending the work already done; such approaches would require explorations of the efficacy of formal and informal lobby groups.

3) In the past few years, a number of historians have taken steps into exploring the place of gender in the history of the space program; all of the work so far has focused on early women contenders for the astronaut corps, the so-called FLATs (First Lady Astronaut Trainees); most of these are narrow "surgical" histories that say little beyond recounting their life histories. The one exception, Margaret Weitekamp's superb *Right Stuff, Wrong Sex: America's First Women in Space Program* (2004), uses the FLATs story to revisit the social and cultural codes that guided broader American views on women, technology, and exploration in late-20th-century America.[116] Yet these

114. Roger D. Launius, "Public opinion polls and perceptions of US human spaceflight," *Space Policy* 19 (2003): 163–175.

115. Michael A. G. Michaud, *Reaching for the High Frontier: The American Pro-Space Movement, 1972–84* (New York: Praeger, 1986); William Barnaby Faherty, *Florida's Space Coast: The Impact of NASA on the Sunshine State* (Gainesville: University Press of Florida, 2002); Sylvia D. Fries, *NASA Engineers and the Age of Apollo* (Washington, DC: NASA SP-4104, 1992).

116. Margaret A. Weitekamp, *Right Stuff, Wrong Sex: America's First Women in Space Program* (Baltimore: Johns Hopkins, 2004). See also Bernice Trimble Steadman with Jody M. Clark, *Tethered Mercury: A Pilot's Memoir: The Right Stuff—but the Wrong Sex* (Traverse City, MI: Aviation

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works still leave much to be done since we still do not have any systematic studies of the role of women in much larger demographics who participated in the space program—in engineering, medicine, administration, and staff positions, as well as the thousands who were spouses in a predominantly male-dominated project;[117] we also need histories of women astronauts who actually flew in space, as opposed to those who never did.

4) We need more studies of how the growth of the space industry has affected particular geographical locales, particularly Texas, Alabama, California, and Florida; space historians need to rise up to the challenge to link subdisciplines such as urban history to space history by chronicling, for example, the transformation of urban sites through development and abandonment cycles or the motivations of many young scientists and engineers to pursue a career in the space program.[118]

5) The American space program was most identified with a White male demographic which reflects the natural distribution of those who managed and participated in the endeavor, yet it is important that we have a good understanding of the role and place of the space program demographic through broader—and, in some ways, cataclysmic—changes in the social fabric of American society from the 1960s to the 1990s in terms of racial relations and immigration.[119]

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Press, 2001); Pamela Freni, *Space for Women: A History of Women with the Right Stuff* (Santa Ana, CA: Seven Locks Press, 2002); Stephanie Nolen, *Promised the Moon: The Untold Story of the First Women in Space Race* (New York: Four Walls Eight Windows, 2003); Bettyann Kevles, *Almost Heaven: The Story of Women in Space* (New York: Basic Books, 2003); Martha Ackmann, *The Mercury 13: The Untold Story of 13 American Women and the Dream of Spaceflight* (New York: Random House, 2003).

117. For recent autobiographical works that touch on broader issues of the role of women engineers in the American space program, see Shirley and Morton, *Managing Martians*; M. G. Lord, *Astro Turf: The Private Life of Rocket Science* (New York: Walker & Co., 2004). See also the piece on women who worked at Australia's Woomera Rocket Range: Kerrie Dougherty, "Calculating Women: A Brief History of the LRWE/WRE Computing Team," *Quest: The History of Spaceflight Quarterly* 9, no. 4 (2002): 31–39.

118. A recent pathbreaking article on the influence of postwar suburbanization on physicists' selection of professional topics is exemplary of the kinds of new work in other fields. See David Kaiser, "The Postwar Suburbanization of American Physics," *American Studies* 56, no. 4 (2004): 851–888.

119. Like the gender issue, the role of race in the American space program has been explored only through the focus of astronauts. See for example, J. Alfred Phelps, *They Had A Dream: The Story of African-American Astronauts* (Novato, CA: Presidio, 1994); Stanley P. Jones, *African-American Astronauts* (Mankato, MN: Capstone High/Low Books, 1998); Mae Jemison, *Find Where the Wind Goes: Moments From My Life* (New York: Scholastic, 2001); Betty Kaplan Gubert et al., *Distinguished African Americans in Aviation and Space Science* (Westport, CT: Oryx Press, 2002). There is also a large canon of juvenile literature on African American astronauts.

Cultural History

The cultural history of spaceflight is the most recent subgenre in the field and also the most heterogeneous. A survey of the key works shows deep and broad work encompassing everything from relatively orthodox studies of the place of spaceflight in American culture to more postmodern meditations on modernity, masculinity, and machines. Perhaps the earliest work in the field was Norman Mailer's *Of a Fire on the Moon* (1969), which, coming as it did in the year of Apollo 11, contrasted sharply with other contemporary accounts of Apollo.[120] Using field research, Mailer constructed a narrative that illustrated the clash—and sometimes rapprochement—between the young counterculture of the late 1960s and the pseudomilitary culture of NASA. Mailer implicitly critiqued what he believed was the militarized and regimented culture of NASA, with its middle-class values that cherished patriotism and encouraged unquestioned adherence to the dominant political culture.

A few authors have explored how the space program has resonated in modern literature. In the insightful *Seeing Earth: Literary Responses to Space Exploration* (1985), Ronald Weber deconstructed many of the attendant metaphors that cultural commentators—writers, poets, scholars, philosophers, theologians, astronauts, and others—have used to invoke, explain, extol, and critique the American space program, locating their meditations between the broad themes of "liberating leap into a mysterious future" and a new appreciation of the Earth itself.[121] William D. Atwill, in *Fire and Power: The American Space Program as Postmodern Narrative* (1994), adopts a similar methodological approach but takes a more critical stance towards the American space program, specifically Apollo. His thought-provoking explorations, which touch on domestic shocks of the Vietnam War, try to unpack "the difficulty so many writers had telling [the] story of a technocratic enterprise simultaneously central and antithetical to the time and place that produced it."[122]

Dale A. Carter also referenced American literature—in his case, Thomas Pynchon's classic novel *Gravity's Rainbow* (1973)—but had a more ambi-

120. Norman Mailer, *Of a Fire on the Moon* (New York: New American Library, 1969). See also W. David Lewis, "Buzz Aldrin's Return to Earth: The Astronaut and Social Values in Apollo Era America," *Quest: The History of Spaceflight Quarterly* 6, no. 1 (1998): 40–43.

121. Ronald Weber, *Seeing Earth: Literary Responses to Space Exploration* (Athens: Ohio University Press, 1985). For other, similar explorations, see Laurence Goldstein, *The Flying Machine and Modern Literature* (Bloomington: Indiana University Press, 1986); George Held, "Men on the Moon: American Novelists Explore Lunar Space," *Michigan Quarterly Review* 18 (spring 1979): 318–342; Laurence Goldstein, "'The End of All Our Exploring': The Moon Landing and Modern Poetry," *Michigan Quarterly Review* 18 (spring 1979): 192–217. For a look at space and the visual medium, see Laura M. Andre, "Lunar Nation: The Moon and American Visual Culture, 1957–1972" (Ph.D. diss., University of North Carolina, 2002).

122. William D. Atwill, *Fire and Power: The American Space Program as Postmodern Narrative* (Athens, GA: University of Georgia Press, 1994), p. 11.

tious goal: to rewrite the postwar history of the American space program as a critique of American expansionist military and economic aims. In Carter's worldview, the American space program represented a "Rocket State," a confluence of civilian and military interests with little or no moral code. The book remains one of the most important synthetic cultural histories of the American space program.[123] Other, similar critiques of the American space program have emerged from the new cultural history and include David Lavery's *Late for the Sky: The Mentality of the Space Age* (1992), which rejects one of the most fundamental assumptions of space mythology, taken as gospel by other cultural commentators such as Wyn Wachhorst, that humans are propelled by unknown and innate forces to explore space.[124]

New work has also focused on popular culture. While not strictly a cultural history, Howard E. McCurdy's *Space and the American Imagination* (1997) remains one of the most powerful studies on how popular conceptions of space exploration in American culture helped to shape national space policy.[125] The iconography of space exploration in the 1950s, McCurdy argued, tapped deeply into some of America's most entrenched cultural ideals such as the "limitless frontier," the "heroic explorer," the romance of aviation through Lindbergh and Earhart, and ultimately the utopian ideal of progress through technology.[126] Space enthusiasts and advocates such as Wernher von Braun used many of the same cultural representations in their lobbying but added the fear of the Soviet threat during the Cold War. By invoking the specter of world domination in the late 1950s and early 1960s, they were able to influence major policy decisions, including Kennedy's historic decision to go to the Moon in 1961.[127] Marina Benjamin's eloquent *Rocket Dreams: How the Space Age Shaped Our View and the Future of Technology* (2003) is the view from the other side, i.e., how the space program has affected popular culture. Her exploration of how popular culture has relegated the "space age" to a cultural

123. Dale Carter, *The Final Frontier: The Rise and Fall of the American Rocket State* (London: Verso, 1988).

124. David Lavery, *Late for the Sky: The Mentality of the Space Age* (Carbondale: Southern Illinois University Press, 1992); Wyn Wachhorst, *The Dream of Spaceflight: Essays on the Near Edge of Infinity* (New York: Basic Books, 2000).

125. Howard E. McCurdy, *Space and the American Imagination* (Washington, DC: Smithsonian Institution Press, 1997).

126. See also James A. Spiller, "Constructing America at the Peripheries: The Cultural Politics of United States Science and Exploration in Outer Space and Antarctica, 1950s–1990s" (Ph.D. diss., University of Wisconsin, 1999); Susan L. Mangus, "Conestoga Wagons to the Moon: The Frontier, the American Space Program, and National Identity" (Ph.D. diss., Ohio State University, 1999).

127. See also Mike Wright, "The Disney–Von Braun Collaboration and Its Influence on Space Exploration," in *Inner Space/Outer Space: Humanities, Technology and the Post-Modern World*, ed. Daniel Schenker, Craig Hanks, and Susan Kray (Huntsville, AL: Southern Humanities Press, 1993), pp. 151–160.

hinterland in the post-Apollo era is a powerful investigation into why the "space age" resonated in the first place to so many.[128]

Along with the works of McCurdy and Benjamin, De Witt Douglas Kilgore's *Astrofuturism* (2003) represents one of the three most important books on the cultural history of spaceflight to appear thus far.[129] Marshaling an impressive array of source material, Kilgore investigates the conflicting ideals embedded in America's vision of the future as represented in intellectual, scientific, artistic, and political discourse of the late 20th century. The power of Kilgore's work lies not only in his explication of how and why a whole progress-oriented and futuristic space discourse resonated with so many in American culture, but also why Americans have found certain values in knowledge, politics, and art so desirable. The work depicts the history of futures propagated, struggled over, and, in some cases, lost.[130]

These recent works point to six different areas within the cultural history of spaceflight fertile for future scholarship:

1) The role of memory, myth, and nostalgia in shaping current understanding of the history of spaceflight remains unexplored; deconstructing the Apollo myth in popular discourse—particularly its resale as cultural cachet via what Michael L. Smith has called "commodity scientism"—may deepen our understanding of why Apollo retains such a grip on the collective memory.[131]

2) Going beyond hagiographical treatments of astronauts, cultural historians should devote attention to the complex role astronauts play as part of the iconography of heroism in American culture; further exploring the groundwork laid by Tom Wolfe in his seminal *The Right Stuff* (1979) as well as focusing on astronauts in the post-Apollo era

128. Marina Benjamin, *Rocket Dreams: How the Space Age Shaped Our Vision of a World Beyond* (New York: Free Press, 2003). See also Paul Levinson, *Realspace: The Fate of Physical Presence in the Digital Age, On and Off the Planet* (London: Routledge, 2003), a similar meditation on the ways in which the digital age may have dampened humanity's urge to explore space.

129. Kilgore, *Astrofuturism*. See also his "Engineers' Dreams: Wernher von Braun, Willy Ley, and Astrofuturism in the 1950s," *Canadian Review of American Studies* 27, no. 2 (1997): 103–131.

130. See also Roger D. Launius, "Perceptions of Apollo: Myth, Nostalgia, Memory, or All of the Above?" *Space Policy* 21 (May 2005): 129–139; Roger D. Launius and Howard E. McCurdy, *Imagining Space: Achievements, Predictions, Possibilities, 1950–2050* (San Francisco: Chronicle Books, 2001); Bruce Horrigan, "Popular Culture and Visions of the Future in Space, 1901–2001," in *New Perspectives on Technology and American Culture*, ed. Bruce Sinclair (Philadelphia: American Philosophical Society, 1986), pp. 49–67.

131. Michael L. Smith, "Selling the Moon: The U.S. Manned Space Program and the Triumph of Commodity Scientism," in *The Culture of Consumption: Critical Essays in American History, 1880–1980*, ed. Richard Wrightman Fox and T. J. Jackson Lears (New York: Pantheon Books, 1983), pp. 175–209.

would add significantly to understanding the shaping and evolution of the astronaut icon from hero and explorer in the 1960s to mechanic and experimenter in the 21st century.[132] Susan Faludi's *Stiffed: The Betrayal of the American Man* (1999), where she argues that the emasculation of the astronaut in the post-Apollo era in part contributed the "betrayal" of the "American Man," suggests that the fall of the astronaut icon was as salient as its rise, but the extant scholarship remains woefully incomplete.[133]

3) A cultural history of the Space Age would be incomplete without fully researched scholarship on the rituals that have shaped the lives of not only participants in the space program but also those who witnessed it as viewers;[134] similarly, we need to revisit the history of space travel through the lens of popular scientific culture.[135] An area ripe for investigation is the ways in which popular space culture shaped the lives of adolescents in the 1960s through science fiction, popular magazines, toys, models, and clubs.[136]

4) The recent graphic anthology *2001: Building For Space Travel* (2001) was an important step in connecting space culture with the history of the built environment on Earth, particularly architecture;[137] there still remains much to be done in terms of connecting the history of space exploration with the history of material culture—automobiles, toys, home appliances—to name only a few examples.

5) Essential for studying the history of space exploration is the role of particular ideologies—whether utopian, spiritual, millenarian, excep-

132. Wolfe, *The Right Stuff.*

133. Susan Faludi, *Stiffed: The Betrayal of the American Man* (New York: William Morrow & Co., 1999). See also Debra Benita Shaw, "Bodies Out of this World: The Space Suit as Cultural Icon," *Science as Culture* 13 (March 2004): 123–144.

134. For early explorations on this field, see several articles by Colin Fries in *Quest: The History of Spaceflight Quarterly*: "Space Age Legends: Urban Folk Tales Collected by the NASA Headquarters History Office" (vol. 8, no. 1 [2000]: 18–23), "Flying for Us: Space Age Milestones Celebrated in Music" (vol. 9, no. 3 [2002]: 30–36), "Sports Milestones in Space" (vol. 10, no. 2 [2003]: 37–40), and "Traditions of the Space Age" (vol. 11, no. 1 [2004]: 31–39).

135. For a notable exception, which primarily covers the media of TV and film, see Robert A. Jones, "They Came in Peace for all Mankind: Popular Culture as a Reflection of Public Attitudes to Space," *Space Policy* 20 (2004): 45–48.

136. For a brief look at the relationship between the proliferation of science fiction and the cause of spaceflight in the U.S., see the essay "Rockets to the Moon, 1919–1944: A Debate Between Reality and Fiction," in Paul A. Carter, *Politics, Religion, and Rockets: Essays in Twentieth Century American History* (Tucson: The University of Arizona Press, 1991), pp. 181–195.

137. John Zukowsky, ed., *2001: Building for Space Travel* (New York: Harry N. Abrams, 2001).

tionalist, modernist, humanist, atheistic, technological, environmental, or other—that motivated advocates, critics, and participants (direct and vicarious) of spaceflight in the 20th century.[138]

6) A few have begun to revisit the history of space exploration through the theoretical framework of feminist studies, some through a reading of such sources as female-written "slasher" novels. Constance Penley's *NASA/TREK: Popular Science and Sex in America* (1997) critically tackles, among many topics, the role of sexuality in spaceflight culture and also discusses NASA's "inability to manage the meanings of women in space";[139] additionally, Yaakov Jerome Garb's ecofeminist approach to reevaluating the famous photograph of the whole Earth from lunar distance focused not on the epiphany of (re)discovering "one world" for all of humanity, but rather on how that iconic image of the Earth helped to entrench a more negative view, one of the dispassionate gaze of omniscient science as a masculine epistemology controlling all of nature, knowledge, and humanity.[140] Finally, in *Cosmodolphins: Feminist Cultural Studies of Technology, Animals and the Sacred* (2000), authors Mette Bryld and Nina Lykke used a critical feminist approach to unpack the relationships between the Space Age, the "New Age," and the ecological symbolism of nature (represented through the icon of the dolphin). In taking a feminist approach to rewriting the master narratives of spaceflight, they identified what I believe is an important topic for future historians, the relationship between national identity and the making of history. They write:

> The early space race was, amongst other things, a discursive battle over entitlement to represent Universal Man in the biggest story told in modern times. Who was going to be the script writer and the protagonist of the master narrative of mankind's cosmic exodus? This was and is a

138. For an unusual look at space culture through "posthuman theory," see Melanie A. R. Brown, "Posthumanity's Manifest Destiny: NASA, Its Contradictory Image and Promises, and Popular Culture" (Ph.D. diss., University of Central Florida, 2004).

139. Constance Penley, *NASA/TREK: Popular Science and Sex in America* (New York: Verso, 1997), p. 3.

140. Yaakov Jerome Garb, "The Use and Misuse of the Whole Earth Image," *Whole Earth Review* no. 45 (March 1985): 18–25, and "Perspective or Escape? Ecofeminist Musings on Contemporary Earth Imagery," in *Reweaving the World: The Emergence of Ecofeminism*, ed. Irene Diamond and Gloria Feman Orenstein (San Francisco: Sierra Club Books, 1990), pp. 264–278. See also Jonathan Bordo, "Ecological Peril, Modern Technology and the (Post)Modern Sublime," in *Shadow of Spirit: Postmodernism and Religion*, eds. Phillipa Berry and Andrew Wernick (New York: Routledge, 1992), pp. 165–178.

> question that matters a great deal when the official story of spaceflight is retold [separately in the U.S. and Russia].[141]

Their conclusions hint at further opportunities for research on national claims for the history of space travel: which was more "important" in the history of space exploration, the first time a human left the planet Earth (Yuri Gagarin) or the first time a human set foot on another celestial body (Neil Armstrong)? Ask a Russian and then an American, and one would get different responses. In both cases, historians use extraordinary metaphors to imbue them with gravity, comparisons that typically center on the movement of Earthly life from the oceans to land. The parallel narratives are contradictory but exist simultaneously in multiple national discourses, buttressed by masculine notions of rationalism, exploration, and evolution. In some sense, space historians need to question how "thematic consensus" in space historiography was shaped by national identity.

CONCLUSIONS

The flavor of American space history has also been profoundly shaped by the location and sponsorship of its primary practitioners. In other words, American *space* history largely remains "court history." For the past 40 years, it has been predominantly sponsored, written, and issued as a result of funding from sources who direct and operate the space program, i.e., the U.S. government (through NASA, the Smithsonian's National Air and Space Museum, and the Department of Defense) or major corporations. Because there has been no vibrant nongovernmental or noncorporate space history community (in academia, public history positions, or elsewhere), American space history has been much more conservative than other historical subdisciplines. The field has typically had a romance with the power and progress inherent in technology; it eulogizes and deifies a few important men; and it eschews any position that would criticize celebratory, jingoistic, or militaristic elements of the space program. The works of those who have broken this mold despite their connections to official organizations—Launius, Logsdon, McCurdy, and Neufeld, for example—collectively represent an important and positive, albeit minority, trend in the field of space history.[142]

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141. Mette Marle Bryld and Nina Lykke, *Cosmodolphins: Feminist Cultural Studies of Technology, Animals and the Sacred* (London: Zed Books, 2000).

142. Michael J. Neufeld's work, particularly his seminal *The Rocket and the Reich: Peenemünde and the Coming of the Ballistic Missile Era* (Cambridge, MA: Harvard University Press, 1995), revolutionized the history of the wartime German ballistic missile program by providing a balanced treatment of the development of the V-2 that did not gloss over the terrible human costs of its development.

The mainstream academic community has devoted very little attention to the space program, partly because academics tend to be narrowly focused on topics such as race, ethnicity, and gender. Typically, academics have had a condescending attitude towards fields such as the history of technology or space history, partly because they see in these fields little of interest to such contemporary conceptual lenses such as poststructuralism; postcolonial studies; feminist studies; and issues revolving around gender, ethnicity, power, transnationalism, and sexuality. Academics have often refused to see the complexities of the space program, relying instead on unidimensional, weak, and often lazy interpretations of the space program as a bankrupt and militaristic element of American society.

The publication of syntheses can say much about a particular discipline. On the one hand, in a field that is very young, one might expect most works to be somewhat of a synthesis given the paucity of subject matter. On the other hand, maturity and longevity of a discipline and its attendant accumulation of source material might also engender the writing of syntheses. Since the beginnings of the field of space history, journalists and historians have tackled the problem of the synthesis with various degrees of success. Von Braun and Ordway's *History of Rocketry and Space Travel* (1966) was an early attempt that emphasized some of the key motifs of Cold War historiography such as exploration, competition, and the social welfare of all humankind. The work focused on great figures, civilian space exploration, and the potential benefits of the project.[143] More comprehensive works appeared in the 1980s and 1990s that benefited from post–Cold War revelations. T. A. Heppenheimer's *Countdown: A History of Spaceflight* (1997) traced the evolution of rocketry from pioneering theoreticians in the late 19th century to the mid-1990s. Heppenheimer's marshaling of information is masterful, and his use of inspiring language complements his view that Apollo was "a drive toward a new human future."[144] Tom Crouch's *Aiming for the Stars: The Dreamers and Doers of the Space Age* (1999) is an eloquent exegesis on innovators in the 20th century who tried to translate their visions of space exploration—both successfully and unsuccessfully—into reality.[145] Although focused on great men and great technology, Heppenheimer's and Crouch's works remain the most successful syntheses in the traditional style of space history.[146]

143. Von Braun and Ordway, *History of Rocketry and Space Travel.* The monograph was published in several updated versions up to 1985.

144. T. A. Heppenheimer, *Countdown: A History of Spaceflight* (New York: John Wiley & Sons, 1997), p. 2.

145. Tom D. Crouch, *Aiming for the Stars: The Dreamers and Doers of the Space Age* (Washington, DC: Smithsonian Institution Press, 1999).

146. For other syntheses, see Andrew Wilson, *The Eagle Has Wings: The Story of American Space Exploration, 1945–1975* (London: British Interplanetary Society, 1982); David Baker, *The History*

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Other recent syntheses remain flawed by their dated interpretations. William E. Burrows, in his *This New Ocean: The Story of the First Space Age* (1998), used an array of recently declassified material from both the United States and former Soviet Union to produce an otherwise eloquent narrative of the entire Space Age.[147] Burrows's work, however, derives solidly from the Cold War framework of space exploration as a battle of noble proportions against a morally untrustable adversary. In demonizing communism as "more insidious" than Nazism, he describes the former as a "cancer, a disease that surreptitiously rode the bloodstream of the world, attacking and devouring every healthy organism in its path and growing bigger and more dangerous as it did so."[148] By dismissing all of Soviet society as cancerous yet eulogizing such men as Sergei Korolev, such works inevitably end up in contradictions since we are left with no insight into how the former managed to produce the likes of the latter. Similarly, Mike Gruntman, in *Blazing the Trail: The Early History of Spacecraft and Rocketry* (2004), provides a well-researched and comprehensive tale of the history of rocketry and spaceflight, with lucid explanations of technologies, but does Burrows one better by repeatedly denigrating not only the Russians but also American and Western liberals who questioned the American space program.[149]

With the rise of the new history, two threads of historiography now exist. One remains celebratory and internalist and the other questioning and externalist. Although there has been spillover from the former to the latter, the reverse, as evident in the works of Burrows and Gruntman, has been less common. It is clear, though, that both traditions have very important contributions to make. The old internalist history, focused on important men and singular artifacts, provided the backbone of our conception of the history of the space program. The new externalist history contributes the rationale, explication—and the critiques—that make the old history meaningful. Despite the large canon of space history, those who have written syntheses have not man-

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of Manned Spaceflight, 2nd ed. (New York: Crown Publishers, 1985); Michael Collins, *Liftoff: The Story of America's Adventure in Space* (New York: Grove Press, 1988); H. P. Arnold, ed., *Man in Space: An Illustrated History of Spaceflight* (New York: Smithmark, 1993); Roger D. Launius, *NASA: A History of the U.S. Civil Space Program* (Malabar, FL: Krieger Publishing Company, 1994); Helen Gavaghan, *Something New Under the Sun: Satellites and the Beginning of the Space Age* (New York: Copernicus, 1998).

147. William E. Burrows, *This New Ocean: The Story of the First Space Age* (New York: Random House, 1998).

148. Ibid., p. 148.

149. In describing the development of the Woomera missile test range in Australia in the 1960s, for example, Gruntman notes that "pacifists and communists tried to interfere with the construction, as their counterparts invariably did with defense initiatives in other countries of the free world, thus serving willingly or unwittingly as a Soviet fifth column" (Mike Gruntman, *Blazing the Trail: The Early History of Spacecraft and Rocketry* [Reston, VA: AIAA, 2004], p. 425).

aged to combine the two in any coherent fashion. One way to engender such a union would be for historians of spaceflight to engage much more actively with the mainstream American history community.[150] Unlike the literature on American history, the writing on American space history is very young, but by engaging with a bigger audience—not only the broader public but also the academic history community—we might benefit from a rich vista of viewpoints that would move us forward from a fledgling subdiscipline to one that is vibrant, mature, and complex. And with maturity, we might yet see a powerful work that brings together the dictates of policy, the forces of society, and the nuances of culture into a grand narrative that chronicles the romance and the reality of this country's efforts to explore space.

150. It is of some importance that in the "list of upcoming meetings" section of the past four issues of *News & Notes*—the regular newsletter issued to the aerospace history community by the NASA History Office—one would find announcements for the many meetings of professional aerospace organizations but none for the annual meetings of the American Historical Association (AHA) or the Organization of American Historians (OAH). See the last four newsletters: NASA History Office, *News & Notes* 21, nos. 1–4 (2004).